

Manage Your Loadset, Post-Deploy

MacTech Magazine
January • 2008

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The Journal of Macintosh Technology

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TIME MACHINE**

**Mass Remote
Management
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**Inheritance
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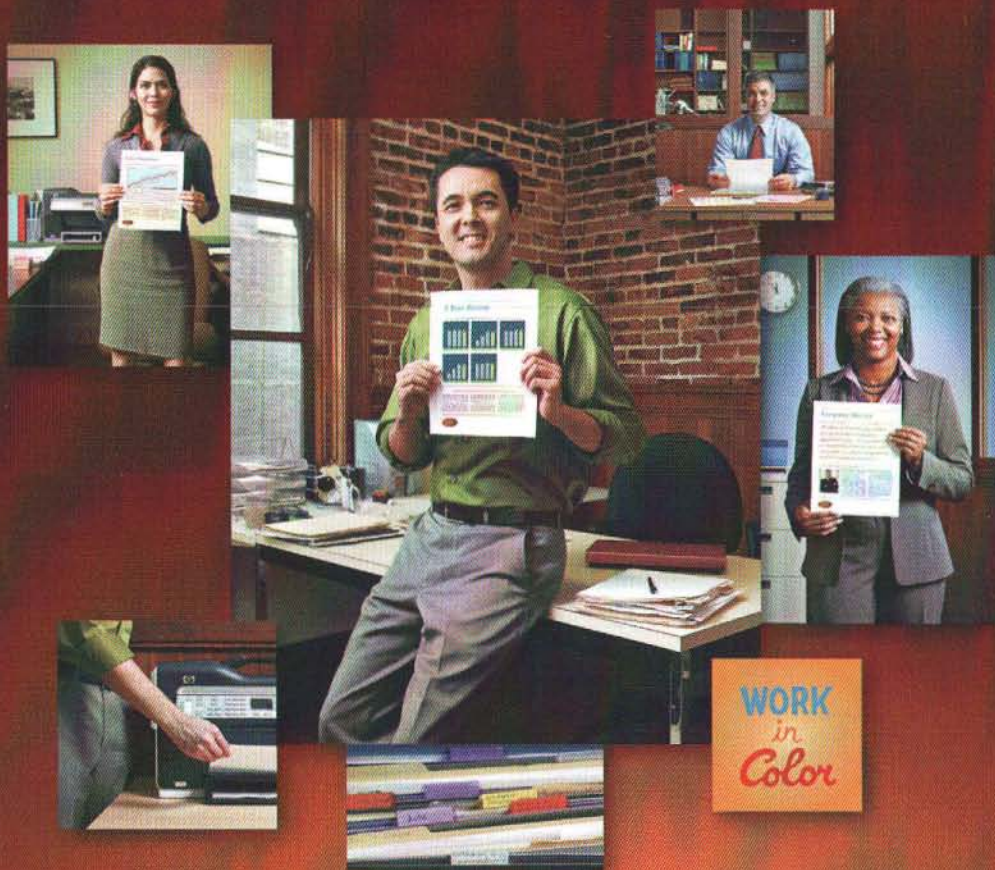
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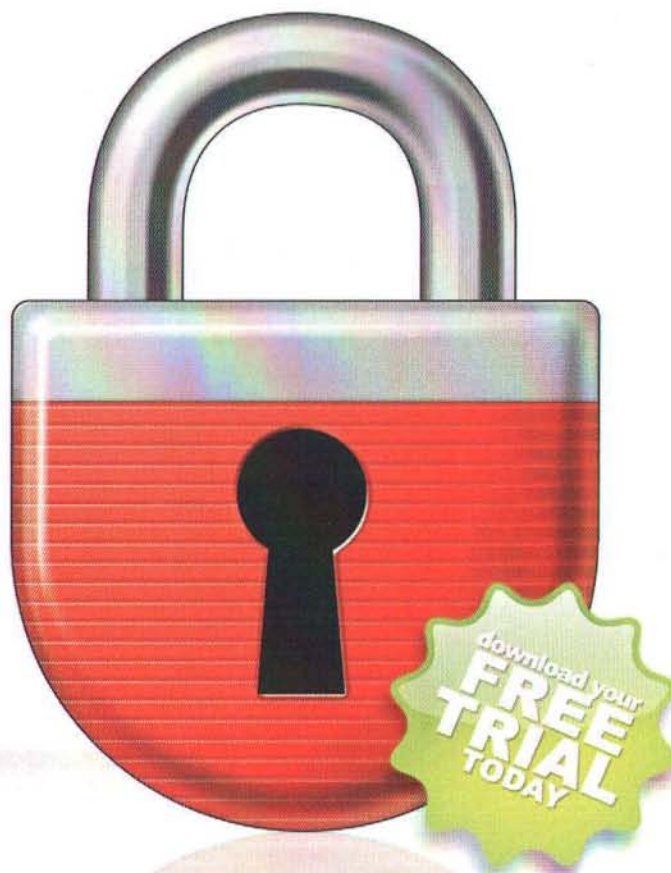
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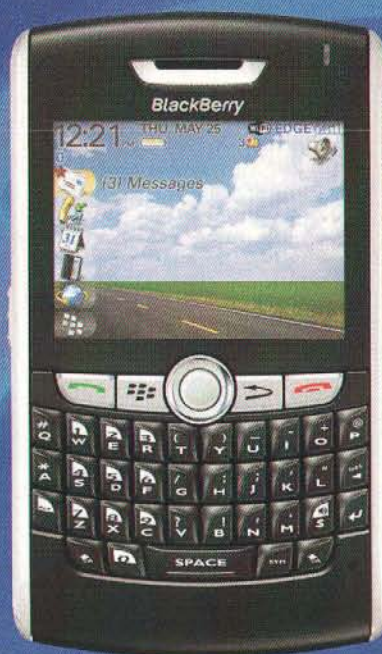
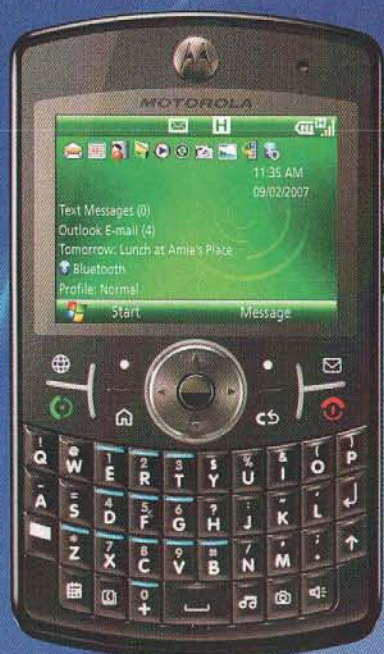
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From the Editor

January brings us the “big show:” Macworld. While there are other Mac-related shows, nothing quite compares to this annual event. Even Apple – as a company – typically waits to make product announcements during this particular week. (If that surprises you, realize that Apple doesn’t own this show like they do Apple Expo).

Of course, it’s really about the Mac community and ecology. Don’t think that you can’t get involved! While it’s too late to do anything formal now, take note of what goes on at the show and be prepared for next year. Aside from the vendor booths, there are many educational sessions (at which I’ll be speaking), gatherings during the week and the simple chance to meet and interact with your peers.

This issue of MacTech should reach you before the show, and, as a reminder, there will be a MacTech booth on the floor. If you brought your copy of MacTech along for your travels, don’t give it away when someone else wants it – send them to the MacTech booth to pick up a copy for themselves!

At MacTech, we’ve been talking about what may be revealed at the show, making plans to see friends and getting the booth ready to greet visitors. This is the first year in San Francisco that the show will be split between two completely separate buildings. I, for one, am intensely curious to see how that works out. A similar scheme became unmanageable back in the days of a mid-year show in Boston – although you had to take a bus between the locations (any current readers remember that?).

Continuing with the show theme, we call this the “show issue” – for obvious reasons – and we’re really happy with what has come together. The big story here is clearly **Time Machine**. Clearly it works. But *how* does it work? What are the caveats of using it? How can you best use it with a mobile system? Returning author **Rich Warren** delves into the magic behind Time Machine, and gives some tips beyond hooking up a FireWire drive for backup time.

Something for everyone this month: **Doug Hanley** brings us part 2 of his detailed look at **Apple Certifications**. With the release of Leopard, there have also been changes to the certification process. If you’ve been waiting to obtain an Apple Certification, there’s never been a better time. Check out Doug’s article to show you the way!

Once your new Macs get set up and into end-users hands, how do you manage them? Do you walk around to each desktop and load the new version of iWork? Of course not, you’re smarter than that! But which of the many tools and methods is right for you? **Brian Best** has written the definitive guide on the topic. On page 62, you’ll find our, “Manage Your Loadset, Post Deploy” article, covering tools such as **ARD**, **LANRev**, **Radmind** and more.

Speaking of remote management, if you’re a command-line-type like me, you may be looking for a command-line tool that lets you spray out commands to list of machines. **ARD** without **ARD**, in a way. My **Mac In The Shell** column walks you through **dshell**, a tool to do just that.

Back in the something-for-everyone category, **Dave Dribin** has been leading us down **The Road to Code**, and is now starting to touch on some advanced topics. This month, we hit the **Inheritance and Polymorphism** milestone – a core concept in object oriented programming.

Last, but certainly not least, we’re happy to be featuring Peter N. Lewis in this month’s MacTech Spotlight. If you’ve been around the Macintosh any length of time, that should be a familiar name. If it isn’t, turn to page 88 *right now* and find out why! It’s OK to start from the back. Really.

If you’re at this year’s Macworld, please visit us at the MacTech booth in the West hall. If you love MacTech and want to turn someone new on to the magazine, send them by for a complimentary copy! If you’re not attending, there’s always enough news coverage to keep you in rapt attention. So, no matter where you are in January, Enjoy!

Edward Marczak,
Executive Editor



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Canada Post: Publications Mail Agreement #41513541

Canada Returns to be sent to: Bleuchip International, P.O. Box 25542, London, ON N6C 6B2

MacTech Magazine (ISSN: 1067-8360 / USPS: 010-227) is published monthly by Xplain Corporation, 850-P Hampshire Road, Westlake Village, CA 91361-2800. Voice: 805/494-9797, FAX: 805/494-9798. Domestic subscription rates are \$47.00 per year. Canadian subscriptions are \$59.00 per year. All other international subscriptions are \$97.00 per year. Domestic source code disk subscriptions are \$77 per year. All international disk subscriptions are \$97.00 a year. Please remit in U.S. funds only. Periodical postage is paid at Thousand Oaks, CA and at additional mailing office.

POSTMASTER: Send address changes to **MacTech Magazine**, P.O. Box 5200, Westlake Village, CA 91359-5200.

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The Road To Certification (Part 2)

Increase your knowledge
and build credibility on the way

by Doug Hanley

Introduction

In this series of articles we have been looking at Apple's IT certifications. We have examined reasons for and benefits of getting certified as well as the testing experience and the changes to Apple's IT certifications that Leopard brings with it. Now we are going to review the exams required for ACSP (Apple Certified Support Professional) and ACTC (Apple Certified Technical Coordinator). We will also discuss how best to prepare to pass those exams and become certified.

ACSP & Support Essentials...

Apple's first level certification for Mac OS X 10.5 is ACSP, Apple Certified Support Professional. The exam will be available starting in February at Apple Authorized Training Centers and Prometric testing centers, and will be approximately 80 to 100 questions in length. The test verifies that you have a core understanding of Mac OS X functionality and that you can successfully configure the key services. It is also expected that you can implement basic troubleshooting and to aid users with the essential capabilities of Mac OS X.

More specific areas covered by the exam are broken down into ten categories. Those ten categories happen to be the same number of chapters in the Peachpit Press book, Apple Training Series: Mac OS X Support Essentials (2nd Edition), ISBN# 0321489810. Correspondingly, those ten categories are also the same number of lessons in the Apple Training class Mac OS X Support Essentials v10.5. The classes are only available at Apple Authorized Training Centers. To find one near you, visit <http://training.apple.com> and click on Locations.

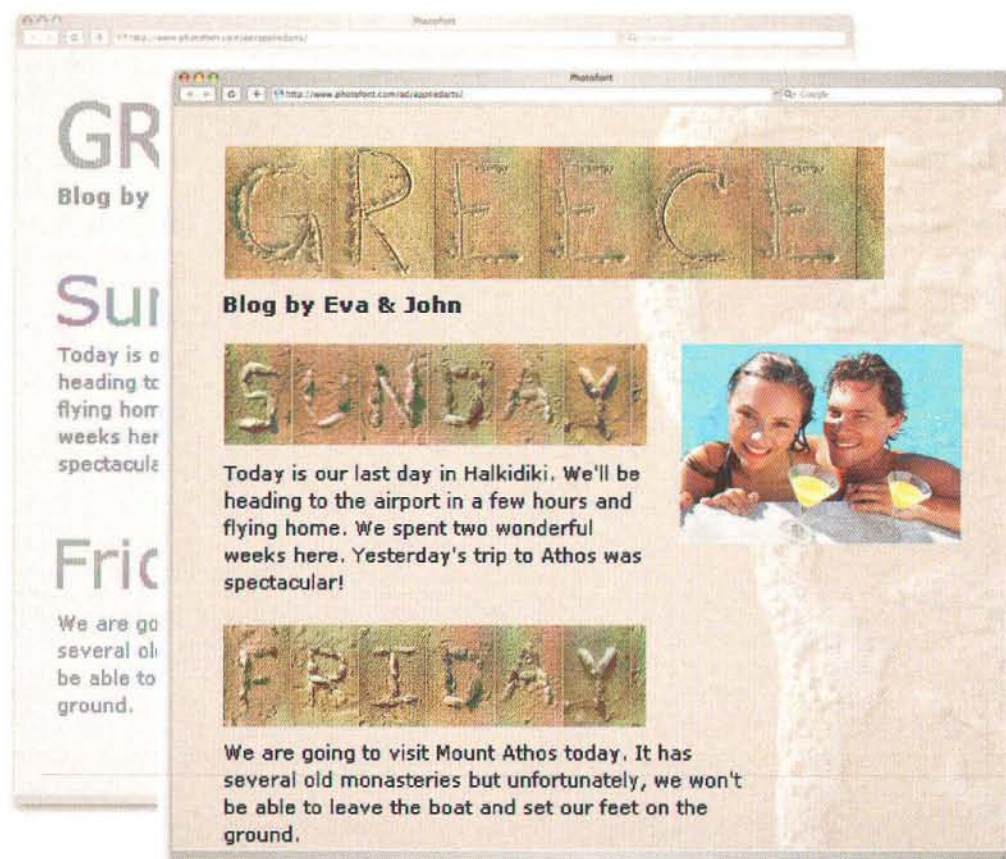
Before I take you through the ten categories, let's examine two ways to prepare for the certification exam. The first, of course, is the Peachpit book. Kevin M. White is the editor of the Support Essentials Book for Mac OS X 10.5.

Each chapter of the book begins by providing an estimate of the length of time it might take one to read the information and complete the exercises. Each chapter concludes with a list of additional resources and a quiz to help you review the material covered. The book is more than just an "Exam Cram" giving you just enough to pass the test publication. It is a solid reference for those looking to build their skills and gain a better understanding of Mac OS X and how to support it. The book has the combination of information and hands-on exercises that can help you master the skills and concepts needed. If you are a visual learner and can absorb technical concepts by just reading, this may be all the preparation you need to pass the test and get certified as an ACSP.

However since we all have different learning styles, this brings us to the next way to prepare for certification: leader instructor-led training. Mac OS X Support Essentials is a three-day hands-on course that is a combination of interactive lectures and case study exercises that offer students real-world challenges and support scenarios. In a classroom situation, you have the benefit of not only asking questions of the Apple Certified Trainer, but also interacting with other students who bring their own points of view, knowledge, and experience in the field. Furthermore, the classroom is a safe place to experiment with the technology (without endangering a production machine) and a safe place to ask questions about concepts or procedures that aren't readily clear from simply reading a book. If you decide to take a course and are evaluating training centers, ask for an instructor who does more than teach - someone who also works in the industry supporting clients in the real world. Often, some of the most valuable information you will get from the course are the practical real world experiences and the solutions discovered in the process of supporting the Macintosh.

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Categories Covered in Support Essentials Exam

So let's get back to the ten categories covered by the Support Essentials exam. The first one covers aspects of installing Mac OS X. It is important to know the base requirements for a machine on which Leopard installed. It is also essential to understand how to troubleshoot an unsuccessful installation and verify a good one. The second category addresses the ways to create, manage and secure user accounts in Mac OS X.

The next two categories are file systems and file management. You should know how to manage the file systems supported by Mac OS X and how to handle permissions and ownership of the files and directories. One of the key areas in of troubleshooting is understanding the file system layout, where things belong and why. You also need to know how files are stored (i.e., packages, plists, resources, images, etc).

The fifth area deals with applications. You need to understand the differences between a Unix process and an end-user GUI application. It is key to know which tools can help you monitor, troubleshoot, and manage those processes and applications.

Next up is network configuration. There is more than one way to connect a Mac to another machine. These days, no Mac is an island; most computers are connected to at least to aone network, if not the Internet. You should understand network protocols, proper network configuration and troubleshooting those connections.

The next two areas are accessing and providing network services. The Mac is a good network citizen and can connect to a variety of different network services. It can also provide those services to other machines. You will need to know what services and protocols are supported, as well as how to configure and troubleshoot those services.

The peripherals category covers all the devices you can physically or wirelessly connect to your Mac, in addition to printing and faxing. To support peripherals you need to know how they are connected and how they are supported by the operating system.

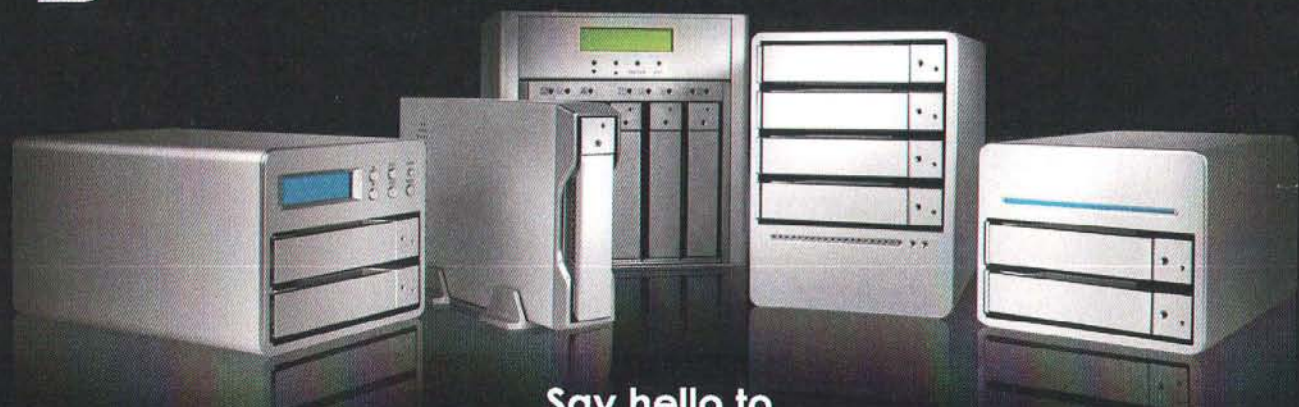
Lastly we deal with the Mac OS X startup process. By knowing what is going on during the startup process you can better determine what area is being affected if a problem is encountered during that process. You need to understand all the phases of the Mac startup sequence.

To reiterate the categories:

- Installation**
- User Accounts**
- File Systems**
- File Management**
- Applications**
- Network Configuration**
- Accessing Network Services**
- Providing Network Services**
- Peripherals**
- Startup Process**

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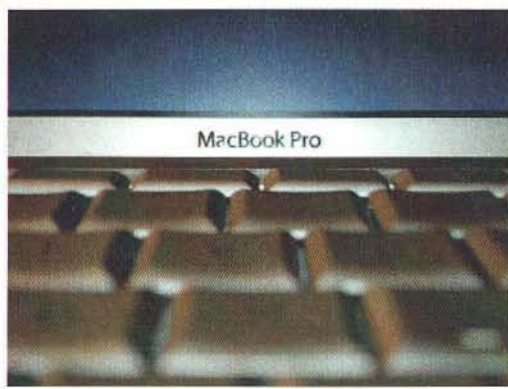
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A more elaborate list of exam objectives will also be in the Skills Assessment Guide (SAG) for the exam when that becomes available on the Apple Training website, <http://training.apple.com/>. As there was for the Support Essentials v10.4 exam, there may also be a Sample Test with a few questions to give you a better idea of what to expect on the exam. The SAG is a great review tool you can use with the book and/or following the training class. After you have passed Support Essentials you are on your way to the next milestone on the road to Apple certification: Apple Certified Technical Coordinator/Coordinator, or ACTC.

ACTC & Server Essentials Exam

ACTC certification is granted when you pass both the Mac OS X Support Essentials v10.5 Exam and the Mac OS X Server Essentials v10.5 Exam. An ACTC is expected to not only know how to work with and support Mac OS X client, but also set up and maintain Mac OS X Server. The Peachpit book based on Mac OS X Server v10.5: Apple Training Series: Mac OS X Server Essentials (2nd Edition) was edited by Schoun Regan, a name well regarded in the Mac IT industry (ISBN# 0321496604).

Again, you can take the self-study approach to ACTC and Server Essentials, but you will need two computers: one running Mac OS X client and the other running Mac OS X Server. Mac OS X Server costs \$499 for 10 User Licenses and only \$999 for Unlimited User Licenses. This could be price limiting for most people. In contrast many Apple Authorized Training Centers not only have the two machines for each student, but some will actually use Xserves as the server for the course exercises. This might be another deciding factor in where you would like to take your training course.

Categories Covered in Server Essentials Exam

There are also ten basic categories in the Server Essentials exam and materials. In the class, there is an eleventh lesson that is the challenge. It builds upon the knowledge and skills you have learned throughout the class and gives you a real world task to implement with multiple machines working collaboratively.

The first category is installation and configuration. It also covers the basic server administration tools. Of course, troubleshooting installation issues is also a key part. The next is providing DNS. DNS is truly the glue that most network services rely upon to function properly.

The third area covered is authentication, authorization and access control. It is extremely important to know how Mac OS X Server handles these concepts of proving who you are and what you are allowed to do on the server and network. Open Directory is the fourth topic, and deals with providing directory services, single sign-on and an introduction to Kerberos.

The next two categories are file services and mail services. File services are among the key uses (reasons?) for a server. You will need to understand what protocols Mac OS X Server

provides and learn how to manage and troubleshoot them as well. Email is also a major use of a server. You should understand how to configure, maintain, and troubleshoot mail service on Mac OS X Server.

Web service and collaborative services are the next two categories. How to host multiple sites and provide WebDAV service are critical. Two of the collaborative services build upon the web server. Wikis and blogs extend Mac OS X Server's web service to provide rich simple collaborative services. iCal services and iChat services will also need to be understood.

Next to last, we have deployment, using Mac OS X Server Netboot/Netinstall to deploy Mac OS X to other machines. You will need to know not only how to configure the service but also troubleshooting issues.

Finally the tenth lesson deals with managing accounts. Part of Open Directory is the ability to manage preferences and network views for your users. You should understand how to manage users this way and troubleshoot that management.

To reiterate the categories:

Installation and Configuration

Providing DNS Service

Authentication, Authorization, and Access Control

Open Directory

File Services

Mail Service

Web Service

Collaborative Services

Deployment Solutions

Managing Accounts

Challenge (only in the class)

When you pass both the Support Essentials v10.5 and Server Essentials v10.5 exams, you will be an ACSP 10.5 (Apple Certified Support Professional) and an ACTC 10.5 (Apple Certified Technical Coordinator). AndDo note that the Server Essentials v10.5 exam applies toward your ACSA 10.5 (Apple Certified System Administrator) certification.

In the next article we should will have more detailed information about the requirements for the ACSA 10.5 certification. We will discuss the kinds of topics covered on the several exams required for the ACSA, and what resources are available to help you prepare for them. Those resources will, of course, will include Apple Authorized Training Center classes and books.

MI

About The Author

Doug Hanley owns MacTEK Consulting & Training, an Apple Authorized Training Center in Las Vegas, NV. His time is divided between teaching and wrangling servers. He has been providing support on the Mac since the early 90's. To track him down, go to

<http://www.mactektraining.com> or doug@mac-tek.com

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MAC IN THE SHELL

by Edward Marczak

Mass Remote Management with dshell

Or, mass remote management *without* ARD

Introduction

A feature article this month covers methods to manage an army of Macs post-deployment. In other words, *after* they've been imaged and rolled out to the masses. The products and methods listed there are certainly applicable and appropriate for many situations. I'm going to describe yet another method that comes in handy in other situations. dsh, the distributed shell, can run a command over groups of machines that you specify. It performs this magic over ssh, so, you can affect machines over LAN or WAN links, near or far. Since OS X and other machines have ssh in their base distribution, you can command across platforms. This article explains how you, too, can send out commands to all or a group of your Macs – simultaneously – with a single press of the return key.

Getting the Goods

While there are many nice apps in the base distribution of OS X, dsh is not one of them. dsh is an agentless controlling app, so fortunately, you only need to retrieve, compile and install on one host, or any admin station that you need. You'll need a compiler on some station to compile the program – typically meaning having Apple's developer tools installed.

Two downloads are needed to get us going. Visit this page: <http://www.neffort.gr.jp/~dancer/software/downloads/list.cgi> and retrieve the latest versions of dsh and libdshconfig. As of this writing, they are:

<http://www.neffort.gr.jp/~dancer/software/downloads/dsh-0.25.9.tar.gz>

<http://www.neffort.gr.jp/~dancer/software/downloads/libdshconfig-0.20.9.tar.gz>

It's easy to take care of *everything* while in terminal: just use **curl** to download the files needed (use "**curl -O http://...**"),

tar to unpack (**tar xzvf filename**) and then it's simple to compile. Both pieces of code compile cleanly in OS X 10.4 and 10.5, and install in `/usr/local` by default. Enter the libdshconfig directory that you just unpacked, and simply enter the following commands (your entries in **bold**):

```
$ ./configure
checking for a BSD-compatible install... /usr/bin/install -c
[output snipped]
config.status: creating Makefile
config.status: creating config.h
config.status: executing depfiles commands
$ make
make all-am
[output snipped]
creating libdshconfig.la
(cd .libs && rm -f libdshconfig.la && ln -s
../libdshconfig.la libdshconfig.la)
$ sudo make install
Password:
/bin/sh ./mkinstalldirs /usr/local/lib
[output snipped]
/usr/bin/install -c -m 644 libdshconfig.h
/usr/local/include/libdshconfig.h
```

Next, we need to do the same for dsh itself. Change into the dsh directory you unpacked, and repeat the same process that you just went through for libdshconfig (configure, make, sudo make install). The entire process should take you less than 5 minutes. Literally.

While you can alter the install directory, I recommend that you leave the default values, and have the binaries and config files installed under `/usr/local`. I'll be referencing that as the install location throughout this article.

You can verify installation by typing "`/usr/local/bin/dsh`". You should be told, "dsh: no machine specified", and dsh would be right.

The configuration

Now that we have dsh installed on our administrative machine, how do we use it? Fortunately, under Leopard, `/usr/local` is a 'blessed' location, and is already in our `$MANPATH`. If you're using 10.4, you'll need to add "`/usr/local/share/man`" to `$MANPATH` and export it, or re-source your init file. dsh comes with some short-but-useful man pages. First, we'll need to update the configuration file.

If you left each application take the default values during their configure stage, and I recommend that you do, you'll find the main config file at `/usr/local/etc/dsh.conf`. We need to make one change to this file. So, whip out your favorite text editor, and change the line that reads:

```
remoteshell =rsh
```

to read:

```
remoteshell =ssh
```


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To: Michael Allen
Subject: Sales Strategies and Solutions

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(If you're daring, this can be achieved in one line with sed: `sudo sed -i .back s/rsh/ssh/ dsh.conf`). You may also want to change the "waitshell" value from "1" to "0". With a setting of 1, dsh will block execution until the previous machine has returned. As I said, you *may* want to change this. It's really applicable for very large rollouts. There's a man page available for the configuration file accessible with "man dsh.conf".

Determining the Target Machines

Before we continue, we need to take a step back and plan things out a bit. We need to determine which machines we're going to be targeting. Since we've chosen ssh as the remote mechanism, each machine that we're going to want to control needs ssh enabled. Now a days, this is the default for most platforms and distributions. That said, unless we want to enter our password each time we make a dsh run, we're going to want to create a public key and install it on any machine that we want to administer. Also, we also need a list of computers for dsh. This list basically tells dsh, "hey - run this command on all of these machines."

ssh was covered extensively in this column in the October 2007 issue, but, as a quick refresher, here's the sequence of creating a public key for ssh's use:

```
$ ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key
(/Users/admin/.ssh/id_rsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in
```

```
/Users/admin/.ssh/id_rsa.
Your public key has been saved in
/Users/admin/.ssh/id_rsa.pub.
The key fingerprint is:
6e:4b:ca:45:2d:c7:3d:14:d2:34:1e:ad:45:a5:fc:8e admin@machine-
name.local
```

In this sequence, you simply press enter when asked for the passphrase and to verify. Notice that the output tells you that "your public key has been saved in...". Change directory to `~/ssh`. We need to copy the contents of the newly generated `id_rsa.pub` file to each machine that we're going to manage. Fortunately, this is a one-time step.

Easiest instructions to write: ssh to the machine you're going to target, using the admin-level account that you'll be running remote commands with:

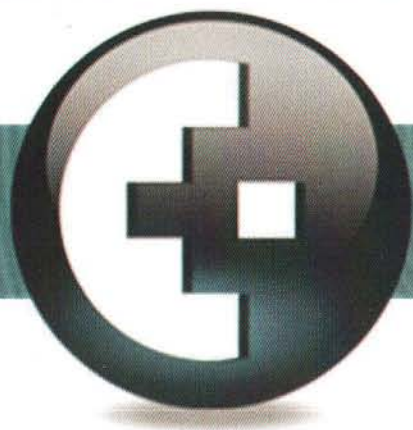
```
ssh admin@remote.example.com
```

Once in, run this command:

```
ssh user@my.machine.com "cat ~/.ssh/id_rsa.pub" >>
~/.ssh/authorized_keys
```

where 'user' is the user account that you just had generate the key for, and "my.machine.com" is the machine where that user id resides - likely the machine you're on right now. Once done, type exit, and then try to ssh again. This time, you should not be asked for a password, but rather, simply receive a remote shell.

In the event that you cannot ssh back to your machine, you can always manually copy your key to the remote machine and



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add its contents to the `~/ssh/authorized_keys` file on the target account. For more about ssh, creating ssh keys and troubleshooting, see my ssh article in the October 200 issue of MacTech Magazine.

While you are accessing each remote machine, you need to keep a list of the account that you're accessing it with, and its fully qualified domain name (FQDN) or IP address. Once complete, take this list and enter it into `/usr/local/etc/machines.list` in this format:

```
/usr/local/etc/machines.list
nyadmin@ny.radiotope.com
caadmin@ca.radiotope.com
fladmin@fl.radiotope.com
azadmin@az.radiotope.com
```

Now comes the fun part!

Spreading the Joy

Let's start with a easy one: viewing the uptime statistics on all of the machines we've identified. This is as easy as:

```
$ dsh -a uptime
16:38 up 14 days, 9:27, 2 users, load averages: 0.19 0.13
0.16
16:38 up 59 days, 7:09, 1 user, load averages: 0.02 0.02
0.00
13:42 up 93 days, 3:25, 2 users, load averages: 0.02 0.02
0.00
1:39PM up 213 days, 4:01, 0 users, load averages: 0.12,
0.08, 0.04
```

It's a complete coincidence that those are in order of uptime! However, that raises the question: what order *are* they in? The `"-M"` switch will prepend the machine name before its output. Let's see that in action:

```
$ dsh -M -a uptime
nyadmin@ny.radiotope.com: 16:41 up 14 days, 9:30, 2 users,
load averages: 0.47 0.27 0.21
fladmin@fl.radiotope.com: 16:41 up 59 days, 7:12, 1 user,
load averages: 0.00 0.00 0.00
azadmin@az.radiotope.com: 13:45 up 93 days, 3:28, 2 users,
load averages: 0.01 0.02 0.00
caadmin@ca.radiotope.com: 1:42PM up 213 days, 4:04, 0
users, load averages: 0.04, 0.07, 0.04
```

There, that's a little better. The `"-a"` switch tells dsh to run the command against *all* machines that we've defined.

If you opted to *not* use a waitshell – your config file still has the line `"waitshell=1"` – you can override this at runtime using the `"-c"` switch. Also, if there's a machine that you have not added to your machines.list file, but want to use it ad-hoc, use the `"-m"` switch. Combining all of these options would look like this:

```
$ dsh -M -c -m txadmin@tx.radiotope.com -a 'last | head -1'
fladmin@fl.radiotope.com: fladmin ttyt0 192.168.70.108
Thu Nov 29 15:22 - 15:22 (00:00)
caadmin@caadmin.radiotope.com: caadmin ttyt1
192.168.70.108 Thu Nov 29 15:09 - 15:09 (00:00)
nyadmin@ny.radiotope.com: nyadmin ttyt2 192.168.70.108
Thu Nov 29 12:29 - 12:29 (00:00)
Password:
txadmin@tx.radiotope.com: root ttys000 wl.z2.nyc-
```

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```
ny.example.net Thu Nov 29 09:29 - 09:35 (00:05)
fladmin@fl.radiotope.com: fladmin      tty0      10.0.2.3
Thu Nov 29 13:37 - 13:37 (00:00)
```

In one fell swoop, this runs the command "last | head -1" on all machine defined in our machines.list file and additionally on "tx.radiotope.com". You'll see the "Password:" prompt in the output above as tx.radiotope.com wasn't preconfigured and is using password authentication. Once the (correct) password is entered, it happily gives us the output we're looking for, just like the other machines.

Final Tips

dsh is useful enough already, but how can we make our lives even easier? First, you may not always want to run all commands on all machines. There are two ways around this. One way is to use a group file. Simply create a file using the same format as machines.list and store it in /usr/local/etc/group/groupname. So, let's say we wanted to target all of our West Coast servers. We could create /usr/local/etc/group/west_coast and add to it:

```
/usr/local/etc/group/west_coast
waadmin@wa.radiotope.com
caadmin@ca.radiotope.com
oradmin@or.radiotope.com
```

Now, we can run commands against just this group:

```
$ dsh -M -g west_coast w
```

This will give us "who" (w) information from each server in the "west_coast" group.

Also, you can specify full server lists in an ad-hoc fashion. Create a file using the machines.list format, and specify it with the "-f" switch.

Nicely, if a machine definition ends up in multiple files, specifying it multiple times will be reduced to a single invocation.

The real magic here is that all input to dsh are simple text files. Decisions can be made, results grabbed from a database, files created on the fly and commands send to appropriate groups of machines. Think about how you could group machines: by location, by service (web, directory services), by class (PPC, dual-proc), by use (administrative, development), etc.

In Conclusion...

Despite the subhead, I don't believe dsh is meant to replace ARD. However, for server management, it may fit into your workflow better *and* can reach out to machines that ARD can't touch (think Linux or BSD servers...even Windows, with the right software and mindset). This can give you some incredible control over armies of machines. You have all the power of a shell on the remote machine. You can be very creative and powerful with this!

Until I found dshell, I used to do something similar by using a for loop to execute commands across machines:

```
for i in `cat servers.txt`; do
ssh root@$i softwareupdate -i -a
done
```

However, dsh has been thought out much more than the "for-loop-solution" and is much more extendible.

Don't run dsh in your production environment until you read the man page, which details some other options for limiting how many remote machines are accessed at any given time. (Look for the -N and -F options, specifically).

Media of the month: *Walt Whitman, The Complete Poems*. Start the year off with some poetry – especially if it's not your usual fare. Walt Whitman doesn't do it for you? Check out James Joyce or Emily Dickenson – there are amazing gems in that timeless writing.

Happy New Year!

Ma

About The Author



Ed Marczak is the owner of Radiotope, a technology solution provider. He is also a husband, father and avid wearer of pants. tail -f /dev/brain at <http://www.radiotope.com/writing>

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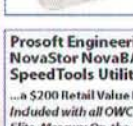
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Networked Backups Using Time Machine

Making easy backups even easier

by Rich Warren

Time Machine Overview

You've heard of Time Machine, right? One of Leopard's most-advertised new features, a complete backup solution so simple even my Aunt Agnes could use it. Just plug in an external drive, and Leopard asks if you want to use it for your backups. Click Yes, and then forget about it.

You won't find a lot of customization. Take a look at the System Preferences. There are only three buttons. You can turn Time Machine on and off, select or change your backup drive, and choose files or folders to ignore. Most people will never need to touch these preferences, since Time Machine provides reasonable defaults. It will back up your entire hard drive and any internal drives, but ignore any attached volumes. Once the initial backup is complete, it will make an incremental backup every hour, recording any and all changes.



Unfortunately, Time Machine cannot backup a File Vault protected home directory while that account is logged in. File Vault users also cannot browse their history or restore individual files. Instead, File Vault users must restore their entire directory using the Leopard install disk.

Time Machine will keep hourly backups over the last 24 hours, daily backups over the last month and weekly backups forever, or at least until you run out of disk space. If Time

Machine needs to free up some space, it will begin deleting the oldest backups first.

Ok, let's see who was paying attention. Show of hands, who sees a problem here? Yep, the oldest backup was the only full backup of our entire hard drive. The newer backups simply record information that has changed. If we delete the oldest backups, won't we lose most of our information?

Not really. There's a little Unix magic going on under the covers here. But, before I explain that, let's look at how the backups are saved.

Backup Format

Time Machine stores local backups in a folder named Backups.backupdb. Within Backups.backupdb you will find more folders—one for each computer using this drive. Yes, multiple computers can back up to the same drive. It just uses up disk space faster.

Inside your computer's folder, you will find even more folders—one for each backup. The folders are labeled with the time and date of that backup. Finally, inside each of these you will find your entire hard drive.

There are two important points here. First, the backups are not encrypted, compressed or stored in an impenetrable binary format. You still need permission to access the files, so other users can't browse through your backups, but Time Machine gives you full access to all your files and folders. *[Ed Note: Of course, these permissions only apply to the computer that the drive is initially connected to. All bets are off for anyone taking this drive to another computer, or, for anyone with admin level access on your Time Machine computer. So, be cautious with this drive if you have any sensitive data.]*

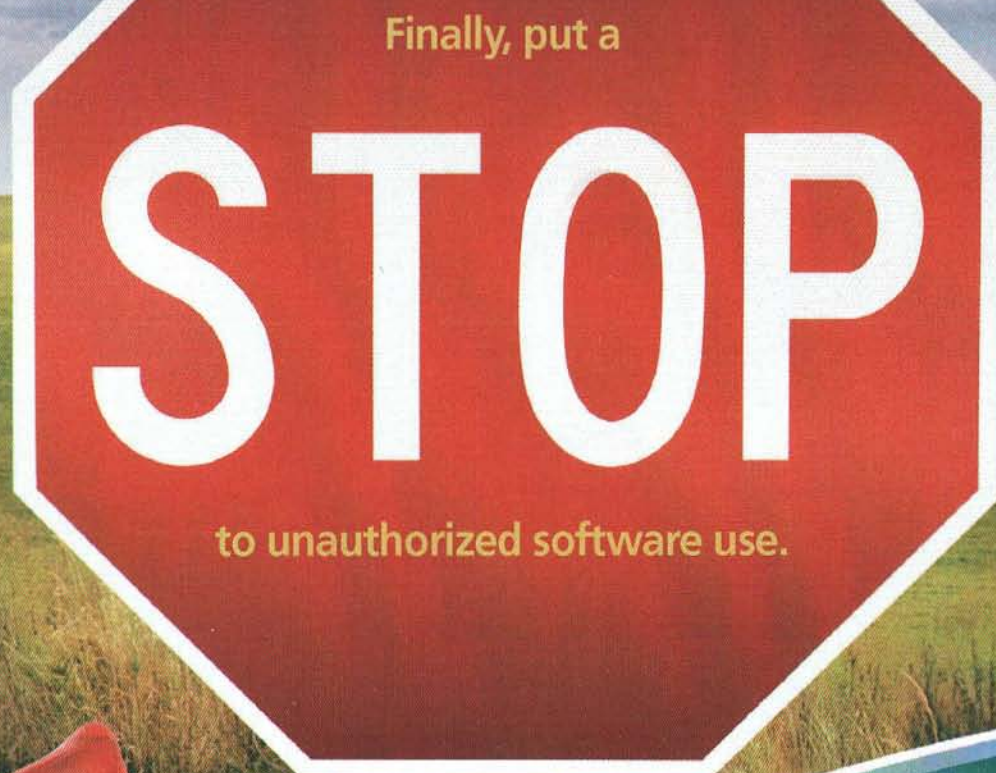
That seems like a little thing, but this little thing warms my geeky heart. Apple has given us complete access to our backups. That means third-party developers can create new utilities to work with Time Machine. I can even browse and restore old files by hand—not that I'd want to. But I can, and that makes me happy.

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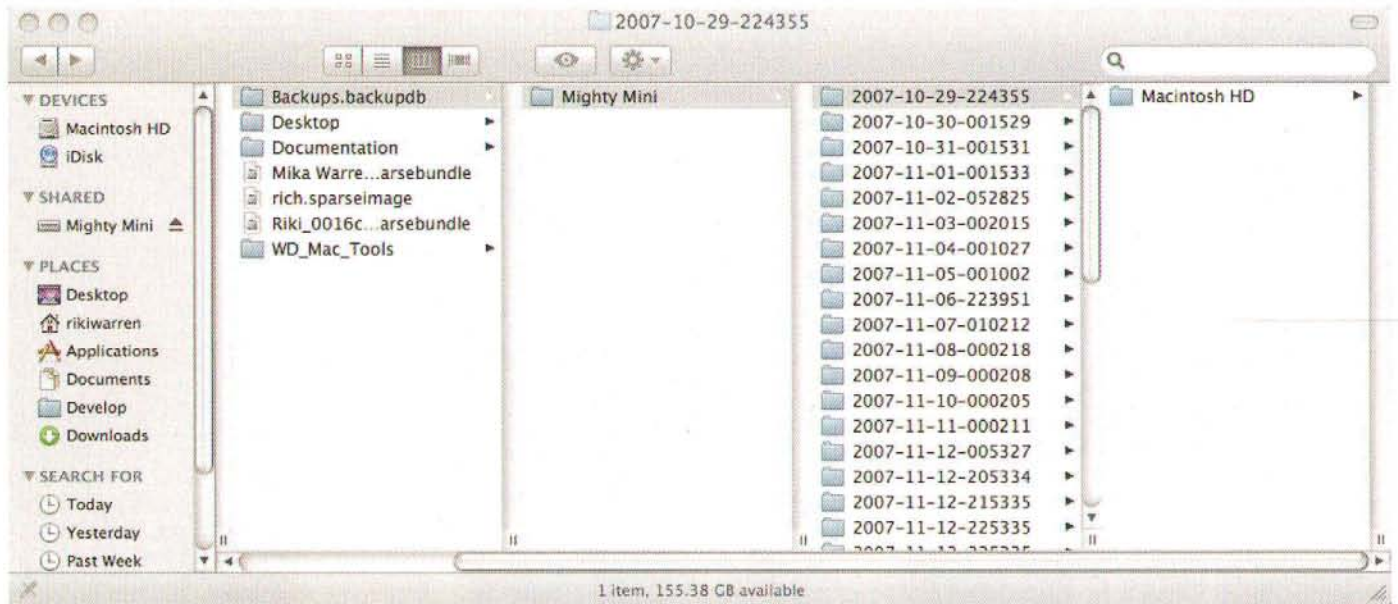
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Time Machine's backups only have one real limitation, we cannot boot from them. However, this seems like a minor quibble. In case of emergency, just boot to the Leopard disk. From there, we can restore our entire system from any backup.

OK, now for the second point: each backup folder contains an entire copy of your hard drive.

Yes, you read that correctly. So, let's see. I have 70+ GB of semi-random data stored on my laptop (don't ask why—I'm not sure myself). My backup drive can hold 500 GB. That means I can make seven backups before my hard drive fills up, right?

Wrong. This is where the Unix magic comes in. Remember, Time Machine only copies files that have changed since the previous backup. If a file has not changed, Time Machine simply makes a hard link to the old file. If nothing inside an entire folder has changed, it will make a hard link to the folder instead.

So, what's a link, and why are they so hard?

Links are the Unix equivalent of aliases. It's a shortcut that points to a file or folder. You can make them from the command line using the `ln` command. Type `man ln` in the terminal for more details.

Links come in two flavors: hard and soft. Soft links are almost identical to aliases. You can use them to access the original file, but if the original file is deleted, the link will now point off into empty space.

Hard links are something different. Special, in a witchy sort of way. From Leopard's man page: "By default, `ln` makes hard links. A hard link to a file is indistinguishable from the original directory entry; any changes to a file are effectively independent of the name used to reference the file. Hard links may not normally refer to directories and may not span file systems."

Basically a hard link creates another name for the information on disk. The original file name and each hard link point to the same information. You can delete the original file, and as long as at least one other hard link

remains, the information stays intact. All existing hard links can still access it—as far as they're concerned, nothing has changed. You have only erased the original file name.

If you want to erase the file, you must erase all hard links to that file. You automatically erase the file with the last hard link.

Apple has taken Unix hard links and mixed in a bit of their own black magic. As the man page suggested, hard links usually cannot point to directories. However, in Leopard they can. [Ed. Note: See Greg Miller's article on *DTrace* in the November issue of *MacTech* for more details on this "magic."] This makes Time Machine considerably more efficient. If an entire directory tree is unchanged, Time Machine can make one hard link to the root of that tree. Without directory hard links, you would need one link for each and every file stored inside.

So, when we delete our oldest backup, we're not necessarily erasing the information. If any other backups have a hard link to a given file or directory, that file or directory will remain untouched. Deleting the oldest backup only erase information unique to that backup.

This bit of magic makes it look like each and every backup contains a complete copy of our hard drive.

You cannot see it using the Finder, but each backup folder also contains a hidden file named `.Backup.log`. These logs record verbose runtime messages from the entire backup procedure. You can mine these logs for interesting information. This includes: the number changed items, the size of the changes, the amount of time spent performing each step of the procedure, and a list of all old backups that Time Machine deleted during cleanup.

Browsing through the log files can give you a better feel for what Time Machine does under the hood. Unfortunately, Leopard's finder no longer has an option to show hidden files, so you will need to use a third party tool like Path Finder, or browse the files using the Terminal.

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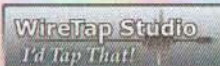
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But how does it know what to back up?

Obviously Time Machine cannot scan every file on your hard drive once each hour. Most backup software saves craziness like this for 4:00 a.m. (or 4:00 p.m. if you're a night owl). Instead, Apple uses the new FSEvents framework to efficiently determine which files have changed.

Apple designed the FSEvents API to passively monitor large sections of your file system. When a change occurs, FSEvents notifies all listening applications. These notifications are course-grained, both in scope and time. FSEvents tells you that the contents of a directory have changed, but it does not tell you which files were actually modified. Additionally, FSEvents combines multiple recent changes within a single directory into one notification. These limitations help keep FSEvents lightweight and efficient.

While notifications are nice, FSEvents goes one step further. It does not just broadcast these events; it also saves them into an event database. This allows FSEvents notifications to persist, even across reboots.

Practically speaking, this means your application does not need to actively listen for events. You can catch events even when the application is not running. When you want to check for events, simply launch the application, and have it query the event database for any changes over the desired time period.

Not surprisingly, FSEvents form the backbone of Time Machine. Fortunately, Apple has opened this API, letting third-party developers use FSEvents in their own projects.

The Problem with Physically Attached Drives

So far everything sounds good. Remember, this is supposed to be a simple system—so simple that everyone will use it. But there's a problem in paradise. Attaching an external drive is fine for a desktop computer, but I do most of my work on a laptop. Constantly plugging and unplugging my external drive seems like a pain.

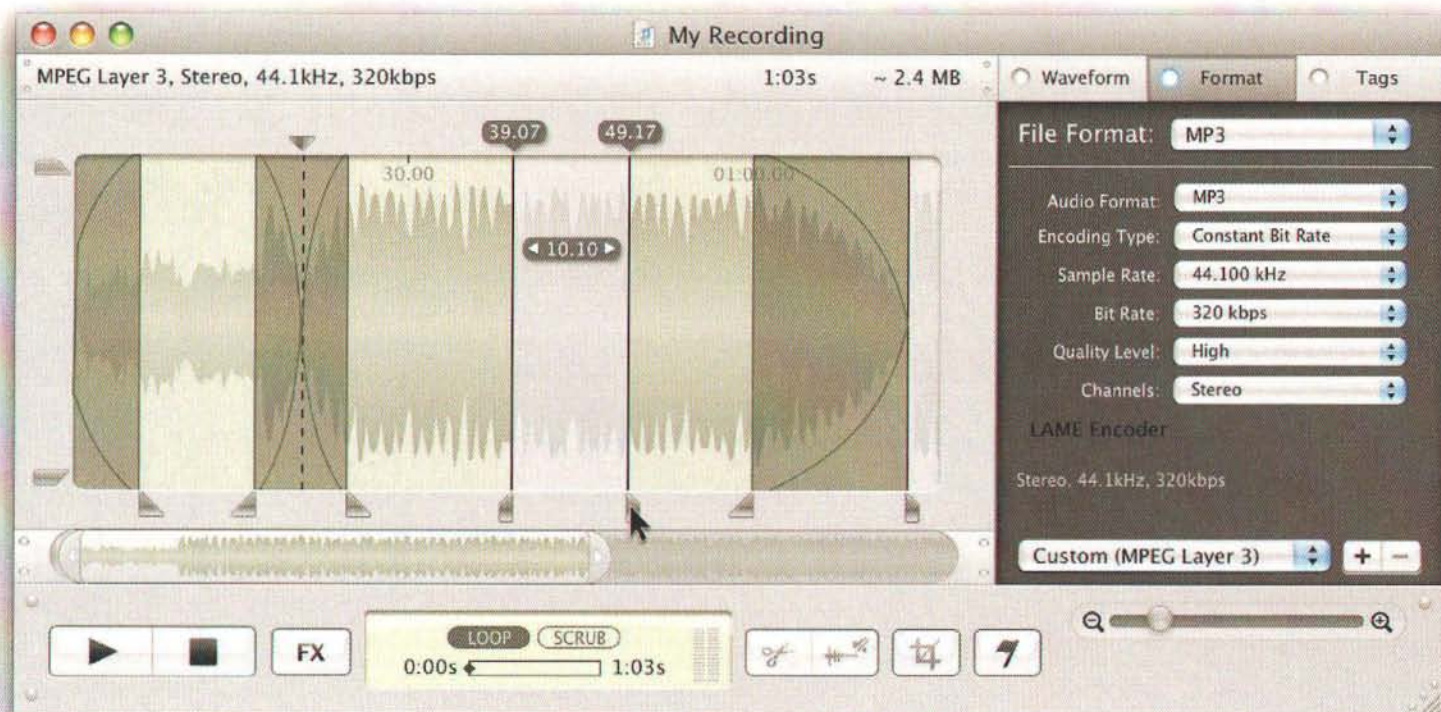
I hate to admit it, but if I have to plug and unplug, I would probably forget to back up my machine. Don't get me wrong. Like most people, I know I should do regular backups, and I would probably be really good about it—for a week, maybe two. But, eventually things would start to slip, and all too soon, months will go by between backups.

If Time Machine hopes to become a real backup solution for the masses, then it has to be invisible. Practically speaking, it must to work with a server or network drive—preferably wirelessly.

The Mysteriously Vanishing Air Disk

Originally, Apple promised backups to a hard disk attached to an AirPort Extreme Base Station. Unfortunately, Apple pulled

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the Air Disk backups just before Leopard's release. Air Disk support may show up in a future update (possibly before you read this). But, as I'm writing, the Air Disk is simply not an option.

Still, all is not lost. Time Machine can back up to another Mac running Leopard (as well as Leopard Server or Xsan storage devices). The host Mac must enable Personal File Sharing using Apple Filing Protocol (AFP).

In my case, I have a Mac Mini with a 500 GB external drive. I use that drive to back up my laptop, my wife's laptop and the Mini itself. The laptops automatically back up whenever they're attached to my wireless network. It all works, almost like magic.

Security and Your Network

Let's take a second to really think about what we're doing. We want to copy everything on our computer to a network accessible drive. By definition, network drives are designed to allow easy access. Sure, we can try to protect the information with passwords and access control, but a networked drive will never be as secure as a tightly firewalled computer. Additionally, we now store all our vital information in two different locations; that was the whole point of the backup after all. Unfortunately, this also means that hackers can access the information if either location is compromised.

Security experts often talk about the struggle between security and convenience—well, networking Time Machine is

incredibly convenient, especially when we use a wireless network. We'll take steps to harden our network in a moment, but let's face facts. If someone is determined enough (or possibly just bored enough), they can probably break in.

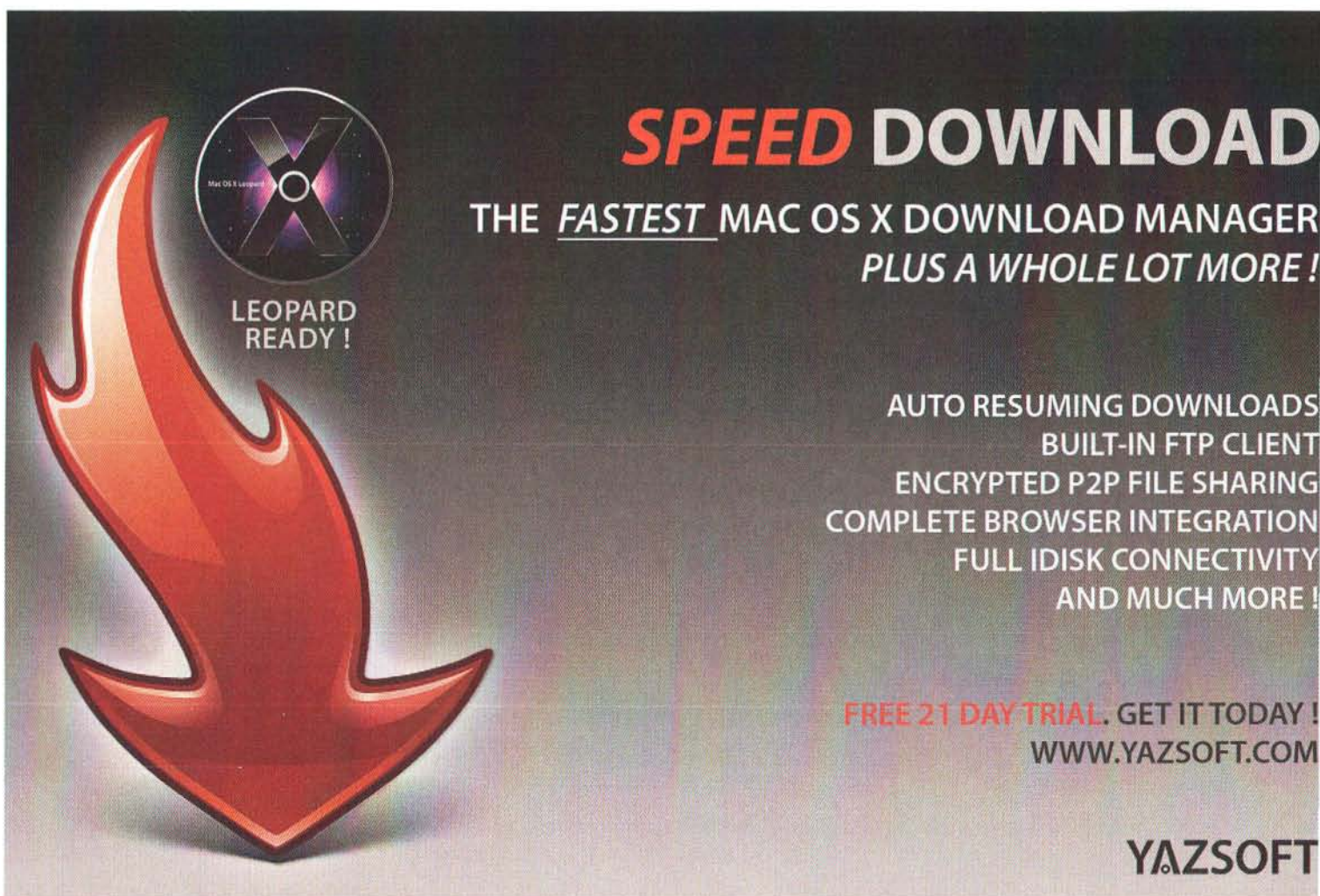
So stop for a second. Take a deep breath, and really think about this. What do you have on your computer? What would happen if someone swiped that information? On the other hand, what would happen if your computer crashed and you lost everything? Talk about rocks and hard places.

For myself, as long as I can make hacking my network inconvenient enough to keep out most script kiddies, I feel reasonably safe. After all, I often leave my laptop attached to my home LAN, even when I'm not using it. If someone really wanted the data, they could always go for the originals.

One last word of warning, I'm not a security expert. These are the steps I use on my own machines, but don't just take my word for it. If you're worried, go out and read up on the subject. Of course, you may not sleep nights afterwards, but at least you'll be forewarned.

Hardening your Wired Network

In many ways, it's much easier to protect a traditional Ethernet LAN. Machines must be physically attached to the network to even see it. Obviously, if the network has no



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connections to the outside world, then no one can see your data.

Unfortunately, most home LANs are connected to the internet, which then opens them to the entire world. Still, all communication between your home LAN and the internet must pass through a single door—your router. So, just like protecting your real property, shut that door and lock it. Keep a careful eye on who comes in, and what goes out.

Start by looking at your router's security options. It's hard to talk in specifics, since each router is different, but basically, if you don't need it, close it. You might look for things like port forwarding or UPnP. Try to make sure you understand what's turned on and why.

The same principle applies for each individual computer on your network. Look at your Sharing preferences. If you don't need them, turn them off. I would also recommend turning on your computer's firewall, and heeding the information in Apple's KB article about the Leopard firewall at <http://docs.info.apple.com/article.html?artnum=306938>.

Of course, even the best firewalls cannot completely protect you. So far, Mac users are lucky. We don't face the same plague of spyware, trojans, viruses and other malicious applications. But that is no reason for lenience. It's just a matter of time.

Malicious software can put your data at risk, so let's be careful out there. Know what you're downloading, and who you're downloading it from. Also, think about the other users on your computer, or the other machines on your network.

If any of them become infected, they might leak information that puts you at greater risk.

Hardening your Wireless Network

Adding wireless networking automatically makes things harder. Radio waves go through walls, and once we start broadcasting, it's hard to limit how far the information travels. We can't simply barricade the front door anymore.

Right now, a team of over-caffeinated, sweaty-palmed 133T HAXORZ might be cruising through your neighborhood in a beat-up '72 Pinto with a duct-taped Pringles-can antenna and a laptop full of cracking software. Stranger things do happen.

More seriously, many people use flawed security practices on their wireless networks. Some exclusively rely on MAC filtering (that's Media Access Control, not Mac the computer) to prevent outsiders from logging into their network. Unfortunately, if your network traffic is not encrypted, there's nothing to stop outsiders from monitoring the unencrypted information that you're broadcasting. Worse yet, you can find software that lets you scrape out and mimic a valid MAC address from the network chatter. On it's own, MAC filtering provides no real security.

The WEP encryption protocol also falls depressingly short. While WEP may keep your neighbor from stealing your wireless to download porn, several weaknesses have been found. Modern software can often break WEP encryption in just a few minutes. Despite this, WEP remains the default on many wireless routers.



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WPA encryption addresses the weaknesses in WEP, but it has problems of its own. The "Personal" mode used on most small networks requires a password. Obviously, your network is only as secure as your password. All the advice on picking secure passwords applies here—with one additional twist. For WPA encryption, longer is better. A typical 6 to 8 character password just won't cut it.

Bottom line, here's my advice: turn on both MAC filtering and WPA encryption. Give it a good, long password (you only need to type it once per computer, so go nuts). And you might want to change your password periodically. Of course, everything I said about wired networks still applies. Shut off any services that you don't need, and enable the firewall on all your machines.

Setting Up the Host

There are three basic steps for setting up the host machine: setup the hardware, create the shared account and then share the drive.

Set Up the Hardware

Technically, you don't need to add an additional hard drive to the host machine. You could just use the host's hard drive, as long as it's big enough. However, I doubt this is a practical

solution. In most cases, you will want to attach an external hard drive.

How large should the hard drive be? That's a very good question. We don't have a lot of real-world experience using Time Machine yet, so I'm afraid I don't have a rock-solid answer. Still, the basic rule of thumb seems simple; buy the biggest drive you can afford. After all, I've never been upset about having too much free space; I always find some way to fill it.

At a minimum, the drive needs to be bigger than all the drives you intend to back up added together. Of course, Time Machine is designed to browse through your hard drive's history. Using a bare minimum hard drive, that history will remain amazingly short. This might let you recover your files when your hard drive crashes, but you won't be able to find that email from your boss. You know, the one you accidentally deleted last week.

Instead, I recommend getting a drive at least twice as big as the total size of all drives you're backing up. That should give Time Machine enough room to back up a reasonable history for each computer.

If you're still having disk issues, you might want to look for the files that are causing the problem. Remember, time machine backs up entire files. If a single bit in a 10 GB file changes, time machine will back up the entire 10 GB.

Usually, this isn't a problem. Frequently changing data tends to live in small files. And large files, like videos, don't typically change. Still, there are a few applications that could cause pain. Virtualization software, like Parallels, often saves

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your virtual hard drive as a single file. This file can easily be 10s of gigabytes in size. If you use Parallels a lot, the virtual drives will change frequently. This could easily bog down even the largest backup drives.

If you find problematic files like these, simply exclude them from Time Machine's backup. Of course, you probably need another way to back up that information, but leave that up to you.

Create the Shared Account

First things first, create a new user on the host machine. This will serve two purposes. First, it adds a layer of protection for your backups. If someone accidentally downloads a malicious program to the host machine, hopefully it will only affect their account, and your backups will remain untouched.

Also, opening a shared drive does present a potential security weakness. If someone manages to break in using the drive, you want the hacker stuck in a restricted account with limited access to the rest of the machine.

To set up the account, open the System Preferences. From the System row, select Accounts.

You will probably need to unlock the Accounts preferences. Click on the lock icon in the bottom left corner, and type in an administrator user name and password.

Click the "+" button under the accounts list. Enter the user name and a secure password for this account. Again, you will only manually enter this password a few times, so go ahead and make it extra passwordy.

Make sure to set the new account type to "Sharing Only". This will create an account specifically designed for remote access. Sharing Only accounts do have a home directory; however, you cannot log into them locally. As the name suggests, they are perfect for our purposes.

Click the Create Account button, and you're done.



New Account: Sharing Only

Name: Shared Drives

Short Name: shared

Password:

Verify:

Password Hint: (Recommended)

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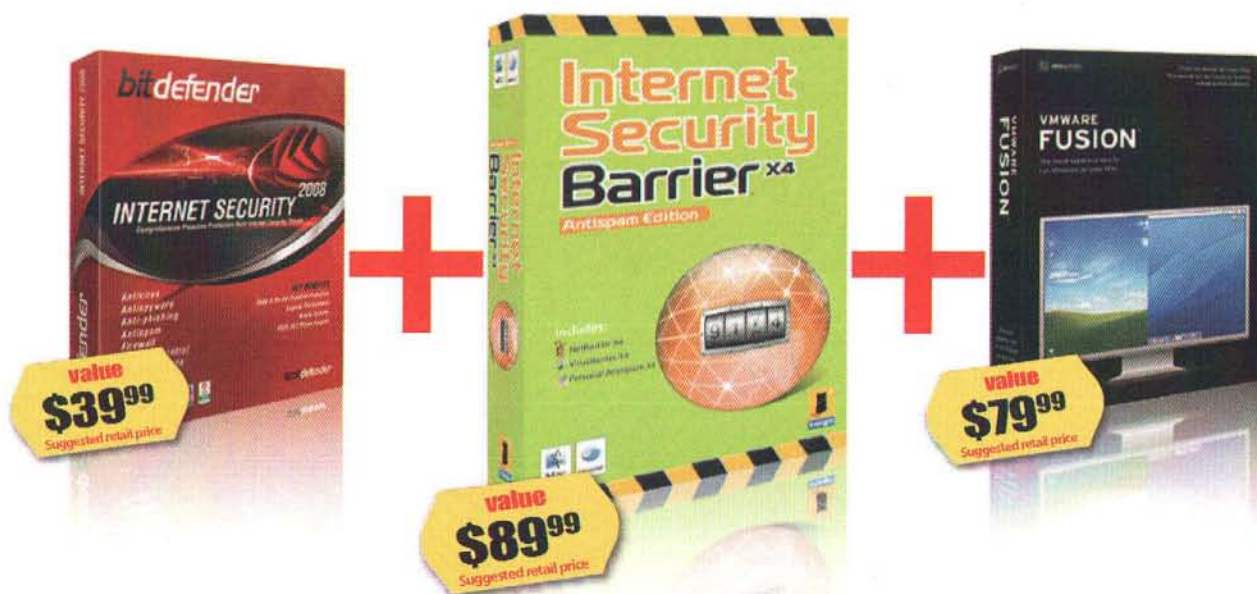
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Share the Drive

In the System Preferences, select Sharing from the Internet & Network row.

Enable File Sharing. By default, your Mac will use AFP. You can enable FTP or SMB sharing by clicking the Options... button, but Time Machine only requires AFP.

Add the external drive to the list of shared folders. Click the "+" button under the Shared Folders list, and select the drive. Note: other computers will not have access to this drive when the host computer is sleeping. You probably want to go into the Energy Saver settings and make sure the computer never sleeps.

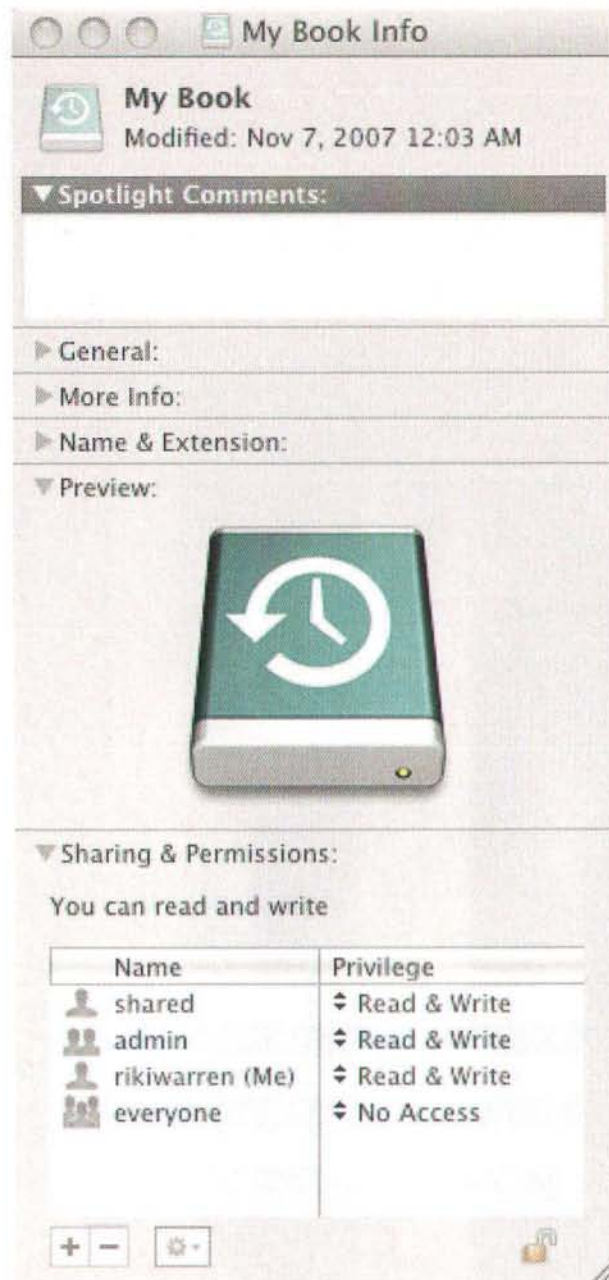


Back in the Sharing preferences, make sure the external hard drive is selected in the Shared Folders list. The Users list now shows the access controls for this drive. Unfortunately, we can only make limited changes here. Instead, let's open the drive's Info window.

Find the hard drive icon on your desktop. Control-click on the disk icon and select Get Information. In the Info window, expand the Sharing and Permissions section. Here, you can modify the access permissions to this drive for any number of users or groups. To unlock the control, simply click the lock icon in the bottom right corner, then enter an administrator name and password.

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For Time Machine to work, the shared user must have both read and write permission. I also gave the administration group similar permissions; this lets me access the drive locally when necessary. Unfortunately, my current account shows up on this list, and I cannot delete it. Since it is already an administrator account, I just mirrored those permissions. Finally, everyone else should default to No Access. If you're not the shared account or an administrator, you don't get to touch this drive.

Once the permissions are set, go back to the Sharing window. Check the access restrictions listed there. They should match the settings from the Info window. If they don't, make any necessary changes. You can also remove the shared folders, if you're not going to use them.

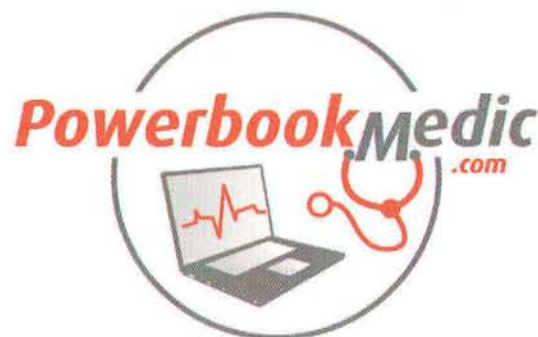
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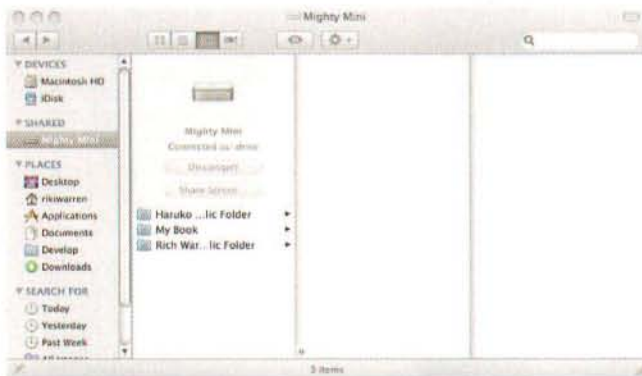
Finally, Leopard only mounts external drives when a user is logged into the host machine. If no one is logged in, you cannot access the shared drive remotely. To fix this, open the command line and type the command listed below (all on one line).

```
sudo defaults write  
/Library/Preferences/SystemConfiguration/autodiskmount  
AutomountDisksWithoutUserLogin -bool true
```

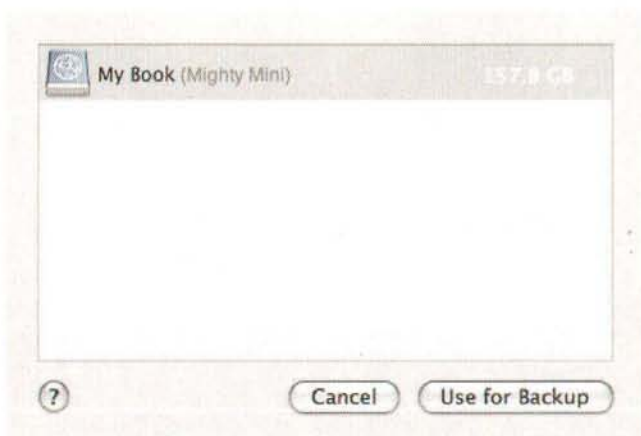
After running the command, restart the host machine. Once it reboots, as long as the machine is turned on, the drive will remain active.

Setting Up the Clients

First the good news, clients are much easier. There's only one catch, you must log into the drive before setting it up. In Leopard, this is easy. The host machine should show up in the Finder's SHARED sidebar. Simply click on the icon, then log in using the shared user and password we created earlier.



You should see the external hard drive in the finder. Now, open Time Machine's preferences (from the System row of the System Preferences). Click the Choose Backup Disk... button. Select the remote disk, and click Use for Backup. Time Machine will ask you for the user name and password again. These let Time Machine automatically log into the external drive when it performs its backups.

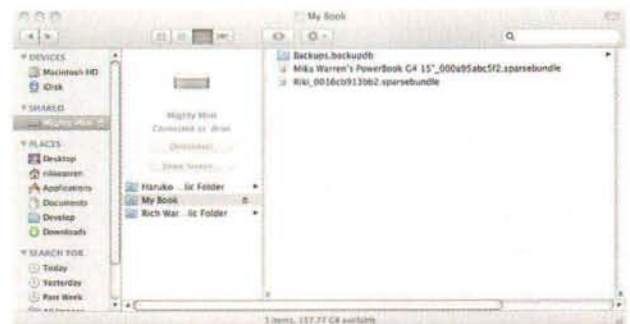


Selecting the drive should automatically turn on Time Machine. Your first backup will run in about two minutes.



Remote Backups

As I described earlier, Time Machine saves local backups to the Backups.backupdb folder. Remote backups are a bit different. Time Machine stores these in sparsebundles. Sparsebundles are a new type of disk image. Like other disk images, they can be mounted and browsed, provided you have the necessary permissions. You can even create new sparsebundles using the Disk Utility application.



Unfortunately solid details about sparsebundles are hard to come by. According to Apple, sparsebundles are more reliable, efficient and scalable than the older sparse images, and they recommend using sparsebundles for any persistent sparse images, as long as the backing bundle is acceptable. As the name suggests, sparsebundles are bundles – in other words, a folder that the Finder treats as a single entity. Since it is a folder, you can dig into the contents. Do so and you'll see a 'bands' directory with slices of that disk image in chunks that may be up to 128MB each. The man page for hdiutil has a little more information.

While sparsebundles can be mounted remotely, you cannot mount them when directly connected to the drive, even when using an administrator account. If you try, you will get a socket error. Finder won't even let you open the

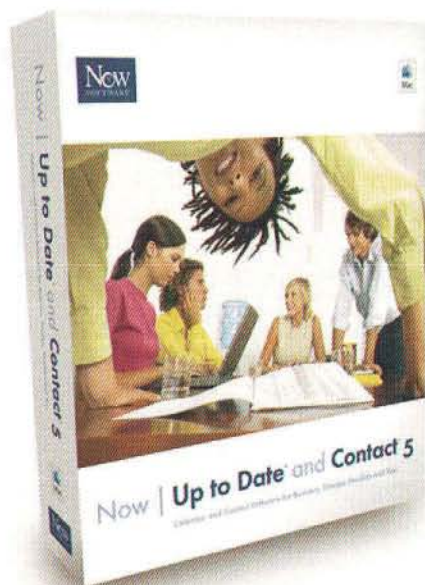


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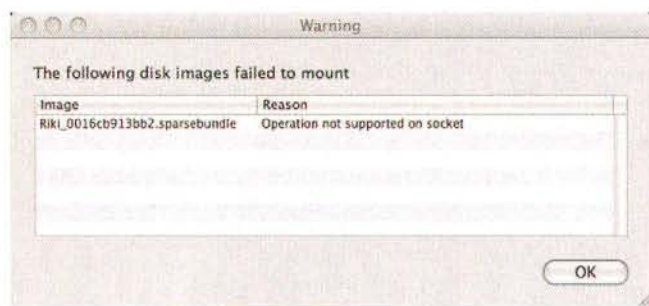
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bundle's contents locally. Ironically, this makes remote backups slightly more secure than local backups.



Time Machine's use of sparsebundles creates at least one small problem. My home wireless network is not the most reliable thing. I tried to backup my entire 70+ GB hard drive over wireless, just letting it run overnight. That never worked. It typically crashed around 12 GB. On the few occasions when shoving massive amounts of data over the air didn't kill the network outright, the transfer took forever. Only a fraction of the work was done by morning, and I don't have that kind of patience.

Ideally, I want to plug the backup drive directly into my laptop, do a complete local backup, then convert it to a remote backup. I made a few attempts at copying the contents of my local backup into a mounted sparsebundle,

but I kept running into permission errors or corrupted bundle errors. I'm not saying it's impossible, but I couldn't get it to work.

Instead, I wired all the computers together into an Ethernet network and ran the initial backups over the wires. Time machine tagged my sparsebundle image with my Ethernet card's MAC address. Still, when I switched to a wireless connection, Time Machine recognized and used the proper sparsebundle. I've tested this on both my MacBook Pro and an older G4 PowerBook, and it worked fine on both machines.

Still, some people are reporting problems when switching between wired and wireless networks. The issue seems to be incorrectly named sparsebundles. If you're having trouble, try creating an alias or even renaming the sparsebundle. Look for the 12-character hexadecimal string after the underscore. Replace that with the MAC address for your wireless card.

Incremental backups tend to be rather small—usually less than 1 GB, so the Wireless network typically handles them with little trouble. But, it's not 100%, at least not on my network. I may not get every hourly backup, but this doesn't bother me too much. My computer gets several backups a day, and that seems sufficient. Anyway, once the backups are older than 24 hours, Time Machine will only keep one per day.

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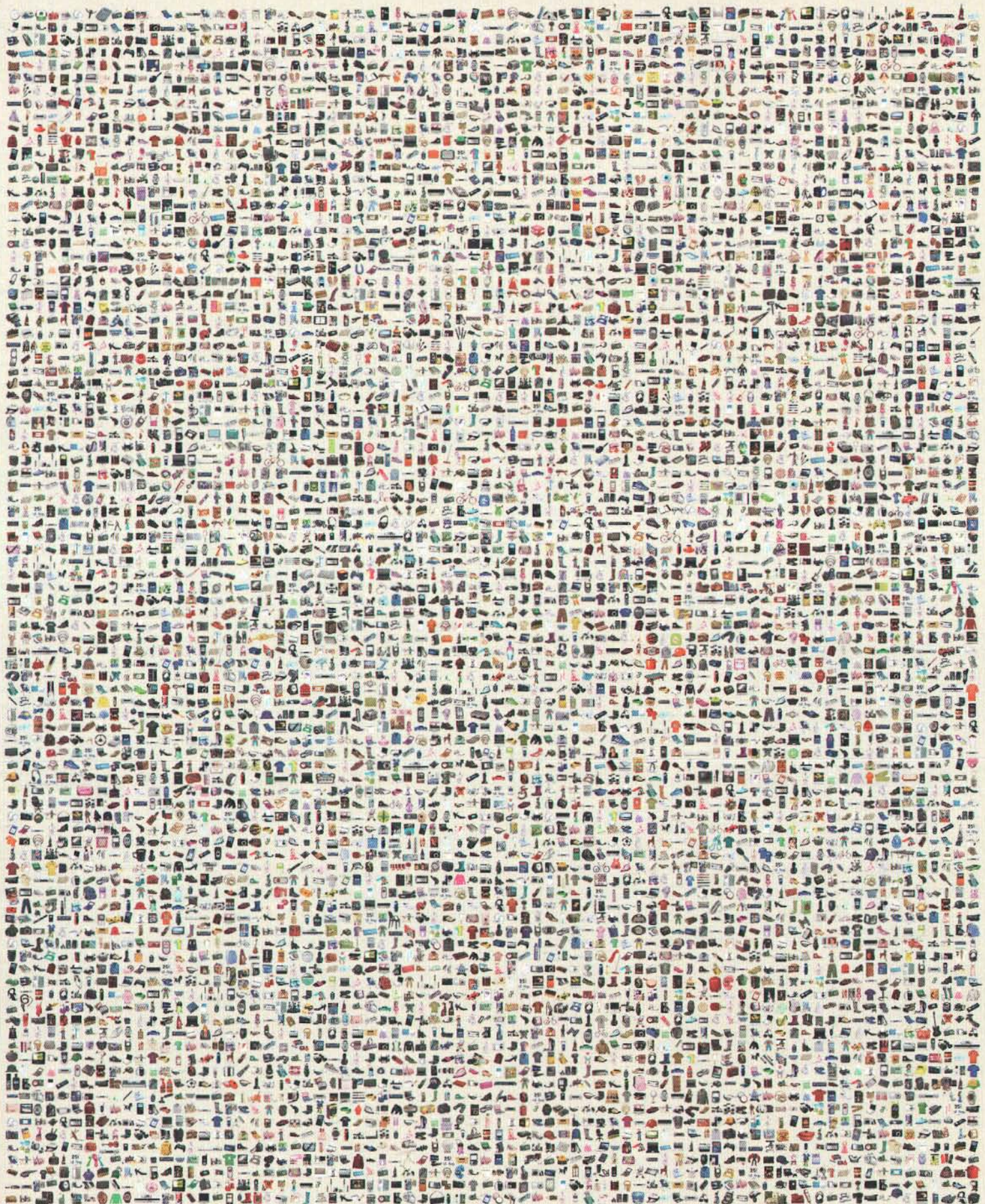
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Time Machine itself runs a little more sluggishly over the wireless network. It can take a minute or more to mount the sparsebundle. But, once it's running, it usually to work reasonably well, network crashes notwithstanding.

Is This Solution Right for You?

So far, I am quite pleased with my wireless Time Machine setup, but it may not be the right solution for everyone. The two main deal breakers are security and performance.

Any time you open a service on your computer, you are opening yourself to possible attacks. No one can prove their software is bug free—so there's always a chance someone will discover a new exploit and use it against your computer.

Performance wise, your experience will very greatly depending on the quality of your wireless network. I think it works well enough as a general backup solution, even on my slow, temperamental network. However, if you frequently dig through older copies of files, then you may want something a bit snappier.

Even if you want to use Time Machine, consider this: Is Time Machine your complete backup solution, or is it just one piece in a larger system.

Time Machine backups work great if you accidentally delete a file, or if your computer's hard drive burns out. But what happens when there's a fire or hurricane or flood? Say someone breaks into your home and steals all your computer

equipment? Typically, your backup hard drive will be in the same general location as your backed-up computer. A disaster that strikes one will likely take out the other as well.

I highly recommend using some sort of off-site backup in addition to Time Machine. You have any number of options here; depending on how much you're willing to pay and how much work you want to do.

If you're a .Mac member, then Backup is probably your simplest option. Or, for a more hands-on approach, you could burn all your important files to DVD and store the backup disks at work, or at someone else's house. I also like using the extra space on my iPod. After all, if there's any one item that I'm likely to have on my person as I run out of a burning building, it's my iPod.

Also look at third party solutions. Many people recommend SuperDuper!, especially for bootable backups. There are also a number of online storage services, like Amazon's S3. Online storage is nice, since the servers are probably in an entirely different state.

The bottom line is simple. Time Machine's quick setup and fire-and-forget usage makes it the ideal first line of defense, but it should not be your only backup solution. That's just asking for trouble.

Other Cool Server Tricks

For this networked Time Machine solution to work, you need a host computer connected to your network 24/7. So, that raises the question, what other services can this machine provide? After all, most of the time it's just sitting there. Here are a few suggestions, but these only scratch the surface.

By definition, you already have a shared drive connected to your network. If you have extra space, you can use that drive as a file server. You don't even need to do anything, the setup described above will let you upload and download files from the networked drive.


The host computer is also the ideal choice for a print server. Simply attach a printer to the host computer and enable Printer Sharing.

You might want to host your primary iTunes library on the host computer. If you share the entire library, bandwidth willing, you can access all of your media from any computer on your local network.

Additionally, you could set up your own web server by enabling Web Sharing. Leopard also includes Mongrel and Ruby on Rails, if you want more-complex web applications. I want to make a small grocery list application. Everyone in my family could add items to the list, and I could print out a copy just before heading to the store. Of course, in the age of blogs and social networks, rolling your own web site is not as exciting as it used to be, but it's still a good learning experience.

To make your web site even more useful, you could use a dynamic DNS server. With a few changes to your router's firewall, anyone on the internet could access your web pages.

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I wouldn't recommend this for a high-volume site, or for a business critical pages. But it might be fun for something small.

Finally, Back to My Mac opens a whole world of interesting possibilities. If you're a .Mac member, Back to My Mac lets you access your host computer from anywhere in the world. You can even remotely control the host using screen sharing. I'm sure we will find any number of interesting tricks for this technology.

Here's a quickie. Say you're hanging out at an internet café. There's a large file that you'd like to download, but you don't want to wait for it. Fire up Back to My Mac and use the screen sharing. Launch Safari on the host computer, and start the download there. Now you can shut down your laptop and forget about it. The download will be waiting when you get home.

You even have limited access to Time Machine while on the road. You can launch the Time Machine application—though, in my case it ran painfully slow. I had more success mounting the backup image and browsing it with the finder. Also, my laptop would not automatically schedule its next backup. I was able to force a remote backup by manually setting time machine to the back-to-my-mac mounted disk. However, after nearly 45 minutes of “preparing”, my connection to the host computer crashed. Bottom line, I wouldn't recommend backing up from a coffee shop's shared wireless network. On the other hand, if you can plug into an office LAN while on a business trip, it might be worth a try.

Conclusion

Time Machine is an excellent backup solution, provided you understand and respect its limitations. Time Machine's main strengths come from its ability to do frequent, incremental backups. Unfortunately, this only works if your computer is regularly connected to the backup drive. For a desktop computer, no problem; however, I don't like having my laptop constantly tethered to an external disk. Laptop users need a remote solution.

In this article we explored remote backups to another Leopard machine. Unfortunately, this solution can be somewhat expensive. Hopefully, Apple will enable Air Disk support soon. Still, using a full-blown computer opens a range of additional possibilities.

I highly recommend using Time Machine to back up to a host computer. You need to understand the security risks involved, and it does not replace a good off-site solution. Still, the next time your hard drive burns out, you will thank me.



About The Author

Rich Warren lives in Honolulu, Hawaii with his wife, Mika, daughter, Haruko, and his new son, Kai. He is a software engineer, freelance writer and part time graduate student. When not playing on the beach, he is probably writing, coding or doing research on his MacBook Pro. You can reach Rich at rikiwarren@mac.com.

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Command Line Goodies

New command line tools in Leopard

By Philip Rinehart, Yale University



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More Tools for the Toolbox

Following last month's article, let's look at some of the more interesting command line tools that have appeared. The first tool, **pkgutil** allows manipulation of the package database. Last month I also talked about the addition of **dtrace**. New to Leopard, major parts of the Dtrace ToolKit by Brendan Gregg have been added. Some of them can prove quite useful in diagnosing and troubleshooting particularly thorny problems.

PKGUTIL

A new command line utility has been added to Leopard, **pkgutil**. What does it do? From the man page, "pkgutil reads and manipulates the Installer's receipt database and flat packages." A database? That's new to Leopard. Let's look at where it is located. Change to `/Library/Receipts/db`. This database contains a record of all packages installed. Let's look at some of the basic options.

Forget. This option discards **all** the receipt data associated with an installed package. However, it **only** forgets the information, it **does not** touch the installed files. If you want to reinstall a package, this option is very useful, as the files will be overwritten and reinstalled. It won't be an upgrade; it will be a full reinstall.

Unlink. This option removes any files associated with a package. Be careful when using this option though, as it does **no** dependency checking and will **not** remove any directories that are contained within the package. However, if a package is only files, this command is quite useful.

Pkgs. All packages known on the system are listed. Here's why this option is important. Look at the Receipts directory, and then run the command `pkgutil -pkgs`. Take close look. Note that if the 10.5.1 update has been installed, there is **no** pkg receipt. It is **only** contained within the **pkgutil** database.

Repair. This option will run repair packages to repair the specified package identifier. Note however, that this option

only repairs packages if they are known to the `repair_packages` utility found in `/usr/libexec`. Let's look at this a little more in depth.

`repair_packages` will repair packages with that are recorded in the standard package list. Here's how to check the list, open `/usr/libexec`, and run

```
repair_packages -list-standard-pkgs
```

Here's what is returned on my system:

System packages on '/':

```
com.apple.pkg.BaseSystem
com.apple.pkg.Essentials
com.apple.pkg.BootCamp
com.apple.pkg.BSD
com.apple.pkg.iPodSupport
com.apple.pkg.PodcastCapture
com.apple.pkg.Directory
com.apple.pkg.JavaToolsLeo
com.apple.pkg.AdditionalEssentials
com.apple.pkg.AdditionalSpeechVoices
com.apple.pkg.AsianLanguagesSupport
com.apple.pkg.MediaFiles
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com.apple.pkg.JavaSDKLeo
com.apple.pkg.X11DocumentationLeo
com.apple.pkg.ServerSetup
com.apple.pkg.ServerAdminTools
com.apple.pkg.update.os.10.5.1
```

Note all the packages, these are the **only** packages that are checked when verifying permissions. Packages can be added, but at this time, this command appears to only accept those that are known by the receipts database. One last thing, the `repair_packages` command allows individual verification of packages. Here's how:

```
/usr/libexec/repair_packages -verify -pkg
com.apple.pkg.ServerSetup
```

Imagine using Apple Remote Desktop to verify or repair permissions on any number of packages! That about sums up the power of `pkgutil` and `repair_permissions`. I've not gone into all of the options, but there are a number of additional options to `pkgutil` which `pkgutil`, which could be used. Read the man page and have fun!

DTRACE AND FRIENDS

Dtrace is quite powerful, but who has time to learn a new programming language? I don't, that's for sure! Here's where

some of the newly included programs can be explored and used when troubleshooting problems.

Snoop commands

Four "snooping" commands have been added, `execsnoop`, `iosnoop`, `rwsnoop` and `opensnoop`. I'll look at `rwsnoop` first. This command will observe reads and writes at the application level. It is really very verbose, and lists each and every read/write operation. It is also hooked in at the kernel level, so it is quite accurate. It's very simple to use to monitor a specific application. First, get the process id (PID), and then use the `-p` option. As an example, to monitor all Mail.app activity:

```
rwsnoop -p PID
```

This command monitors any read/write activity for the Mail.app application. Of course, one does not need to specify a particular application, but it is far more useful to only monitor one.

Input output monitoring

Three commands are included to track disk input/output, `iotop`, `iopending`, and `iopattern`. The one I like here is `iotop`. When troubleshooting a slow system, `iotop` presents a listing much like the `unix`/`UNIX`/`nix` `top` command. On a sluggish system, one could track the drive activity to determine what was slowing a system down.

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Included scripts written in d

Lastly, many new commands have been included in Leopard, all written in d, the dtrace programming language. They are all located in /usr/bin. A couple of commands are particularly interesting. The first is creatbyproc.d. Run it in the following way:

```
dtrace -s creatbyproc.d
```

Note the output. It tracks files as they are created by process id. Let's look at another useful d script, filebyproc.d. This command will track files by process. How about yet another? Pathopens.d tracks files by the path, and the count. Here's what the output might look like:

```
COUNT PATHNAME
1 Leopard/.
2 /dev/dtracehelper
2 /dev/urandom
2 /usr/share/locale/en_US.UTF-8/LC_COLLATE
2 /usr/share/locale/en_US.UTF-8/LC_CTYPE
2 /usr/share/locale/en_US.UTF-8/LC_MESSAGES/LC_MESSAGES
2 /usr/share/locale/en_US.UTF-8/LC_MONETARY
2 /usr/share/locale/en_US.UTF-8/LC_NUMERIC
2 /usr/share/locale/en_US.UTF-8/LC_TIME
24 /dev/
```

Open /usr/bin and explore some of the other d scripts. While not all of the dscripts are there, most are.

One last thing, Brendan Gregg has provided a whole range of one-liners, most of which work on Leopard. Here's their location: http://www.brendangregg.com/DTrace/dtrace_oneliners.txt. Troubleshooting problems with these tools is now so much easier. I've already solved some problems I previously couldn't seem to solve.

Well, that's about it for this month. Play with these new command line tools, as they really increase the arsenal available to any Macintosh system administrator. Until next month, I'll see you on the lists!

MM

About The Author

Philip Rinehart is co-chair of the steering committee leading the Mac OS X Enterprise Project (macenterprise.org) and is the Lead Mac Analyst at Yale University. He has been using Macintosh Computers since the days of the Macintosh SE, and Mac OS X since its Developer Preview Release. Before coming to Yale, he worked as a Unix system administrator for a dot-com company. He can be reached at: philip.rinehart@yale.edu.

The MacEnterprise project is a community of IT professionals sharing information and solutions to support Macs in an enterprise. We collaborate on the deployment, management, and integration of Mac OS X client and server computers into multi-platform computing environments.



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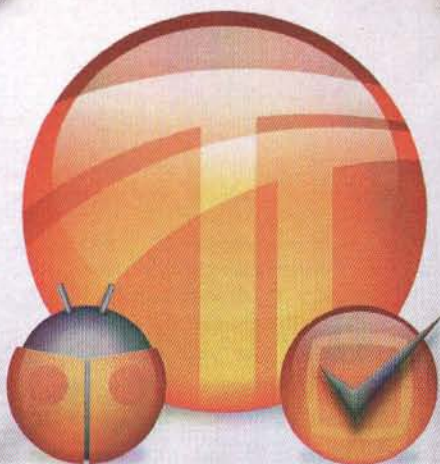
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THE ROAD TO CODE

by Dave Dribin

You Have Your Mother's Eyes Inheritance and Polymorphism

From Rectangles to Circles

Last month in *The Road to Code*, we started writing Objective-C code, and we ended up writing a class that represents a geometric rectangle. I'll list it here for those who skipped out last month:

Listing 1: Last month's Rectangle.h

```
#import <Foundation/Foundation.h>

@interface Rectangle : NSObject
{
    float _leftX;
    float _bottomY;
    float _width;
    float _height;
}

- (id) initWithLeftX: (float) leftX
    bottomY: (float) bottomY
    rightX: (float) rightX
    topY: (float) topY;

- (void) setRightX: (float) rightX;

- (float) area;

- (float) perimeter;

@end
```

Listing 2: Last month's Rectangle.m

```
#import "Rectangle.h"

@implementation Rectangle

- (id) initWithLeftX: (float) leftX
    bottomY: (float) bottomY
    rightX: (float) rightX
    topY: (float) topY
{
    self = [super init];
    if (self == nil)
        return nil;

    _leftX = leftX;
    _bottomY = bottomY;
    _width = rightX - leftX;
    _height = topY - bottomY;

    return self;
}

- (void) setRightX: (float) rightX
{
    _width = rightX - _leftX;
}

- (float) area
{
    return _width * _height;
}

- (float) perimeter
{
    return (2*_width) + (2*_height);
}

@end
```

```
self = [super init];
if (self == nil)
    return nil;

_leftX = leftX;
_bottomY = bottomY;
_width = rightX - leftX;
_height = topY - bottomY;

return self;
}

- (void) setRightX: (float) rightX
{
    _width = rightX - _leftX;
}

- (float) area
{
    return _width * _height;
}

- (float) perimeter
{
    return (2*_width) + (2*_height);
}

@end
```

We also wrote a simple program that uses this new class:

Listing 3: Last month's main.m

```
#import <Foundation/Foundation.h>
#import "Rectangle.h"

int main (int argc, const char * argv[])
{
    NSAutoreleasePool * pool =
        [[NSAutoreleasePool alloc] init];

    Rectangle * rectangle;

    rectangle = [Rectangle alloc];
    rectangle = [rectangle initWithLeftX: 5
                                   bottomY: 5
                                   rightX: 15
                                   topY: 10];

    printf("Area is %.2f\n", [rectangle area]);
    printf("Perimeter is: %.2f\n", [rectangle perimeter]);

    [rectangle setRightX: 20];
    printf("Area is %.2f\n", [rectangle area]);
    printf("Perimeter is: %.2f\n", [rectangle perimeter]);

    [rectangle release];

    [pool release];
    return 0;
}
```

Now, let's say we also want a class that represents a geometric circle. And let's also say we want to have methods that calculate the area and perimeter, just like our rectangle class. As a quick refresher on circle geometry, I refer you to Figure 1:

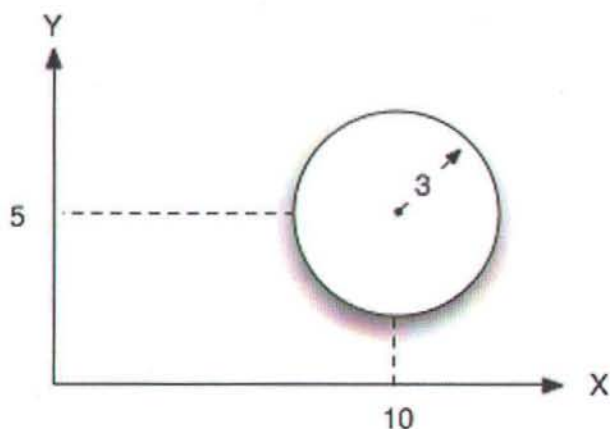


Figure 1: Geometric circle

From this diagram, we can see the circle has a center point of (10, 5) and a radius (r) of 3. Here are the equations for area and perimeter:

$$\text{Area} = \pi \times r^2 = \pi \times 3 \times 3 = 28.27$$

$$\text{Perimeter} = 2 \times \pi \times r = 2 \times \pi \times 3 = 18.85$$

We will design our data structure to keep track of the center point and the radius. The header file for a Circle class is defined in Listing 4.

Listing 4: Circle.h, first attempt

```
#import <Foundation/Foundation.h>

@interface Circle : NSObject
{
    float _centerX;
    float _centerY;
    float _radius;
}

- (id) initWithCenterX: (float) centerX
    centerY: (float) centerY
    radius: (float) radius;

- (float) area;

- (float) perimeter;

@end
```

This class has instance variables for the center point and radius, and the constructor allows us to create a circle using these values, too. The **area** and **perimeter** method declarations are identical to those in the header of our rectangle class. Now let's look at the implementation of this circle class:

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Listing 5: Circle.m, first attempt

```
#import "Circle.h"
#import <math.h>

@implementation Circle

- (id) initWithCenterX: (float) centerX centerY: (float)
centerY
    radius: (float) radius
{
    self = [super init];
    if (self == nil)
        return nil;

    _centerX = centerX;
    _centerY = centerY;
    _radius = radius;
    return self;
}

- (float) area
{
    return M_PI * _radius * _radius;
}

- (float) perimeter
{
    return 2 * M_PI * _radius;
}

@end
```

Okay, that's fairly straightforward, too. The only new part is the `M_PI` constant, which is value of π and is defined in `math.h`, which we have imported. Now, let's take the main function we used to test out our rectangle class and adapt it to our circle class:

Listing 6: main.m to test Circle

```
#import <Foundation/Foundation.h>
#import "Rectangle.h"
#import "Circle.h"

int main (int argc, const char * argv[])
{
    NSAutoreleasePool * pool =
        [[NSAutoreleasePool alloc] init];

    Circle * circle;
    circle = [[Circle alloc] initWithCenterX: 10
                                         centerY: 5
                                         radius: 3];

    printf("Area is %.2f\n", [circle area]);
    printf("Perimeter is %.2f\n", [circle perimeter]);

    [circle release];

    [pool release];
    return 0;
}
```

This is very similar to the `Rectangle` test program in Listing 3. The only change I made was to chain the `alloc` and `initWithCenterX:centerY:radius:` method calls together on one line. Method chaining, i.e., calling a method on an object returned from another method call, is often done for object initialization like this.

You will almost always see the `alloc/init` combo chained together. If we run this, it should produce the output:

```
Area is 28.27
Perimeter is 18.85
```

Inheritance

This is all well and good, but now, let's mix it up a bit. Let's say we want to mix rectangles and circles in one application and print out the area of both of them. The simplest way to accomplish this is to just have two separate `printf` statements, like this:

```
Rectangle * rectangle;
rectangle = [[Rectangle alloc] initWithLeftX: 5
                                             bottomY: 5
                                             rightX: 15
                                             topY: 10];
```

```
Circle * circle;
circle = [[Circle alloc] initWithCenterX: 10
                                         centerY: 5
                                         radius: 3];
```

```
printf("Area is %.2f\n", [rectangle area]);
printf("Area is %.2f\n", [circle area]);
```

This should get us the following output:

```
Area is 50.00
Area is 28.27
```

If we are printing the area a lot, we would want to put this into a separate function called, say `printShapeArea`. However, we run into a bit of a snag. How can we write one function that can print the area of rectangles *and* circles? It turns out we can by writing a `printShapeArea` function with the following signature:

```
void printShapeArea(NSObject * shape);
```

You'll notice that our function takes a `shape` of type `NSObject *`. You've seen `NSObject` before in the header files for our classes, but I've just glossed over it. Take the first line of the `Rectangle` class as an example:

```
@interface Rectangle : NSObject
```

It turns out that classes are organized into a hierarchy, sort of like a family tree. Every class we create must have one parent and can have zero or more children. The word after the colon allows us to provide the name of the parent class. Thus, this line says that we are creating a new class named `Rectangle` with a parent class of `NSObject`. Conversely, this means that `Rectangle` is a child class of `NSObject`. Our `Circle` class is declared very similarly, with its parent class also as `NSObject`.

There's also some fancy object-oriented terminology for these family relationships. The parent class is called the *superclass*, while a child class is called a *subclass*. To confuse the matter, a superclass is also known as a *base*



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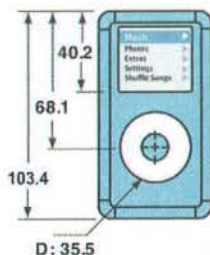
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class, and a subclass is known as a *derived class*. We can draw out the relationships between classes in a diagram that looks a bit like a family tree. This diagram is called a *class hierarchy*, and it would look like Figure 2 for our **Rectangle** and **Circle** classes. The little triangle points to the parent and indicates that the classes below are subclasses.

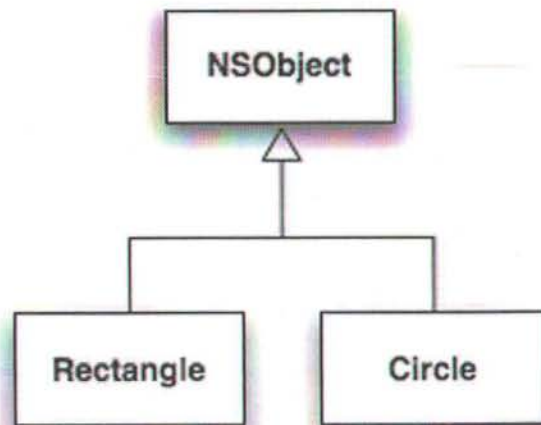


Figure 2: Class hierarchy

Looking at this diagram, it's clear that both **Rectangle** and **Circle** share **NSObject** as an ancestor. It's this common superclass that allows us to use **NSObject *** as the type used for the **printShapeArea** function. Remember that Objective-C, like C, is a statically typed language. This means that parameters to all functions and methods are given a type, and the compiler will complain if you try to pass an object of a different type to that function or method. However – and this is a distinguishing point of object-oriented programming – anytime a function or method requires a certain class, you can always pass any subclass without conversion. This means, for example, that a function that takes a parameter of type **NSObject *** can be passed any subclass of **NSObject** without conversion. Since both **Rectangle** and **Circle** are derived from **NSObject**, they may both be passed to **printShapeArea** without conversion. Thus, we can replace the **printf** calls in our **main** function with:

```
printShapeArea(rectangle);  
printShapeArea(circle);
```

However, the implementation of **printShapeArea** gets a little tricky. This is because the automatic type conversion for related classes is one-way only. You can only automatically convert to superclasses, or up the class hierarchy, but you *cannot* automatically convert to a subclass. Let me show you the implementation, and then we will walk through it:

Listing 7: printShapeArea

```
void printShapeArea(NSObject * shape)  
{  
    float area = 0;  
    if ([shape isKindOfClass: [Rectangle class]])
```



```

{
    Rectangle * rectangle = (Rectangle *) shape;
    area = [rectangle area];
}
else if ([shape isKindOfClass: [Circle class]])
{
    Circle * circle = (Circle *) shape;
    area = [circle area];
}
printf("Area is %.2f\n", area);
}

```

The tricky part about converting to a subclass is we don't know what kind of class the variable `shape` is. It could be a `Rectangle` or it could be a `Circle`, we just don't know. However, we *can* ask an object what kind of class it is an instance of, and that's what the `isKindOfClass:` method is doing. Asking an object about its type at runtime is called *introspection*. First, we ask if it is a `Rectangle` class. If it is, we convert the generic `shape` to a rectangle using this syntax:

```
Rectangle * rectangle = (Rectangle *) shape;
```

This conversion syntax is called a *cast*. The problem is that casting an object from one type to another is very dangerous. You're basically overriding the compiler and saying "Yes, this `shape` really is a rectangle," and it will blindly trust you. If, for some reason, this is *not* a `Rectangle`, you will most likely crash your program. But we can get away with a cast here because we just asked the object if it was, indeed, a `Rectangle`. Because it said "yes," we know we can perform

that cast safely. Once we perform the cast, we can call the `area` method to find out the rectangle's area.

If the object is not a `Rectangle` class, we then ask if it is a `Circle` class. If it is, we do a similar cast to the `Circle` class, and then call the circle's `area` method. Finally, we print the area, which we got from either the rectangle or the circle. And voila! We have our generic `printShapeArea` function. Pass in any `shape`, and it will print the area.

It's worth noting that the methods defined in a superclass are available to all subclasses. Just as real-world children inherit traits from their parents, classes inherit methods from their superclasses. That's also why subclassing is also referred to as *inheritance*. We just demonstrated why this is useful. You'll notice we used the `isKindOfClass:` method. But where did this method come from? We didn't define it in our `Rectangle` class, but it is inherited from `NSObject`. I've said before that all objects are descendants of `NSObject`. `NSObject` provides a lot of base functionality that all these subclasses inherit, including features such as memory management and introspection. We'll get to see more of `NSObject`'s features in later articles.

Polymorphism

Looking at the `printShapeArea` function in Listing 7 with a critical eye, we'll see a couple of issues. First, it's a fair amount of code. What we gain in flexibility, we lose in readability. However, the real issue is that it's not even that

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flexible. Sure, we can pass in either a `Rectangle` or `Circle`, but what if we create a new shape, say `Triangle`, which can also calculate its area? Now we have to modify our function to check for the `Triangle` class. In fact, every time we add any new shape, we'd need to update this function. That's a fragile situation, and it's not a good property of well-designed code.

The second issue is that there's nothing stopping us from passing a non-shape object to this function. Remember that `NSObject` is the common ancestor of all objects. It doesn't make sense to pass in a number object such as `NSNumber`, because it doesn't have the area method. Even though Objective-C is statically typed, it won't properly detect this condition with our current implementation.

To solve both of these issues, we can create a new, intermediate `Shape` class. This is a subclass of `NSObject`, but it will be the superclass of both `Rectangle` and `Circle`. The first step is to create the `Shape` class, with no implementation. The empty header is presented in Listing 8 and the empty implementation in Listing 9.

Listing 8: Empty Shape.h

```
#import <Cocoa/Cocoa.h>

@interface Shape : NSObject
{
}

@end
```

Listing 9: Empty Shape.m

```
#import "Shape.h"
```

```
@implementation Shape
```

```
@end
```

Now, we make this the superclass of `Rectangle` by changing its `@interface` line to:

```
@interface Rectangle : Shape
```

And similarly, we make `Shape` the superclass of `Circle` by changing its `@interface` line to:

```
@interface Circle : Shape
```

By subclassing `Shape` like this, our class hierarchy now looks like Figure 3.

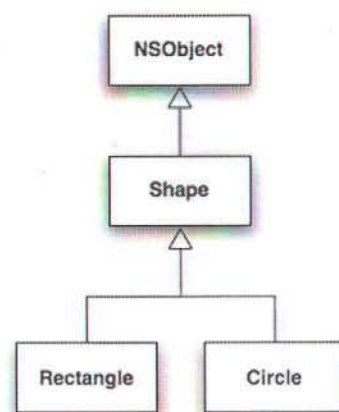


Figure 3: Class hierarchy with Shape



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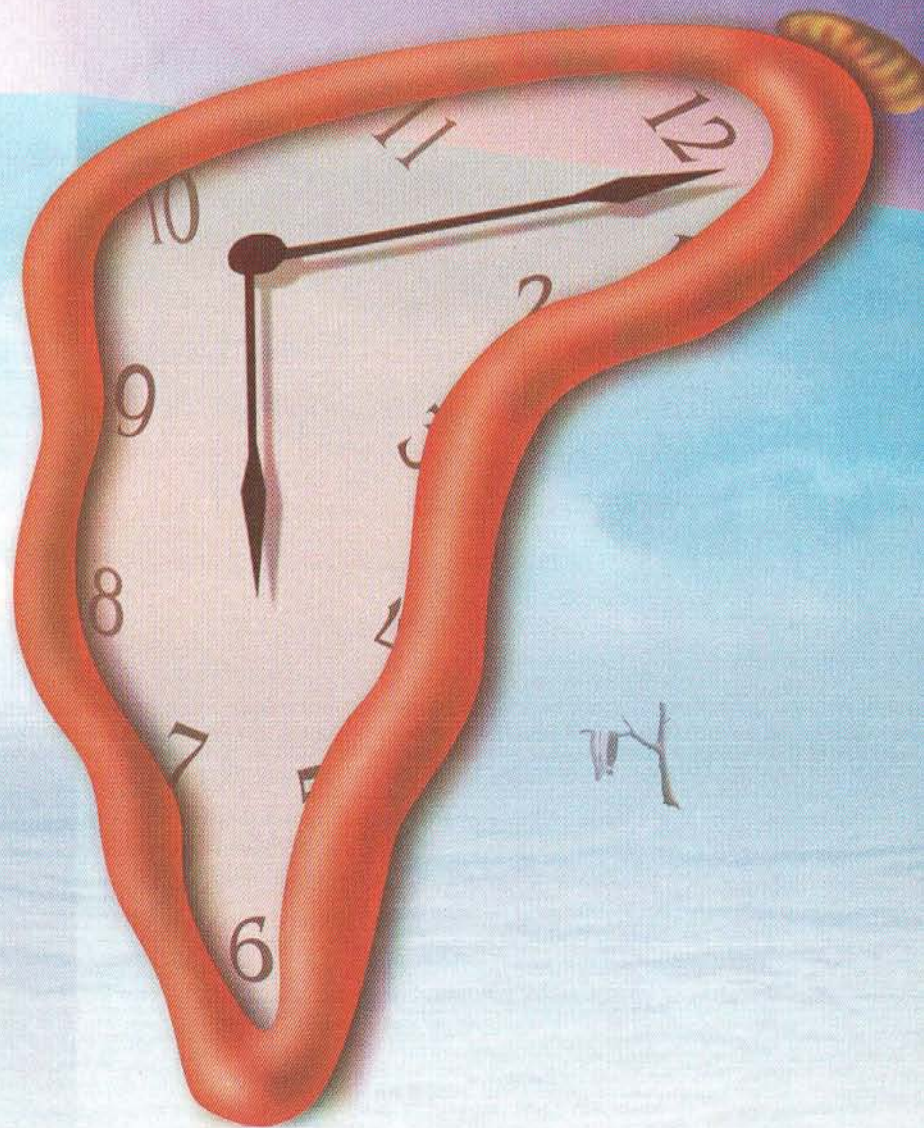
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Finally, we change the signature of `printShapeArea` to:

```
void printShapeArea(Shape * shape)
```

This solves the problem of passing a non-`Shape` object to `printShapeArea`. If we tried to pass a number object, the compiler will now warn us. It will allow `Rectangle` and `Circle` because both are subclasses of `Shape`, and can be converted to `Shape` due to the inheritance hierarchy. However, this doesn't actually reduce the amount of code or allow us to avoid casting. We can achieve this by another refinement to the `Shape` class.

You'll notice that the `area` method for `Rectangle` and `Circle` both have the same signature: no arguments and return a `float`. Because this method signature is exactly the same, we can add an `area` method to the `Shape` class. What should we do for the implementation? Since an unknown `Shape` has an undefined area, let's just return 0.

Now we have a very interesting situation. We've defined the `area` method in both a superclass and subclass. With two different implementations, which one gets chosen when `[rectangle area]` gets called? The rule is that the deepest implementation in the class hierarchy wins. Thus, in this case, `Rectangle`'s `area` trumps `Shape`'s `area`, and `Rectangle` is said to *override* the `area` method. Method overriding is an important feature of object-oriented programming, and every OO language should allow you to do this.

Overriding plays a very important role, though. You'll notice that both `Rectangle` and `Circle` override `Shape`'s `area` method. So what's the point of having this method, then, if it will never get called? It allows us to simplify `printShapeArea`, by removing the introspection calls and casting:

```
void printShapeArea(Shape * shape)
{
    float area = [shape area];
    printf("Area is %.2f\n", area);
}
```

Now at first glance, you might think that this will always print "Area is 0.00" even when passed a `Rectangle` or `Circle` instance. After all, the `Shape` implementation always returns 0. However, through the magic of OO, this actually prints the correct results:

```
Area is 50.00
Area is 28.27
```

How is this possible? It turns out that even though `shape` is of type `Shape` in our code, the object really is still a `Rectangle` or `Circle` at heart. Method calls take into account what type the object really is, instead of what type the code says. In fact, Objective-C won't figure out which `area` method will be called until we actually run the program. This magic is called *polymorphism*. It is also sometimes referred to as *late binding* since the method call is not bound until the actual invocation of the method at runtime, not compile time.

The immediate benefits of polymorphism are readily apparent. All of our introspection and casting code goes away

and `printShapeArea` becomes a two-line function. However, the benefits go deeper. By using polymorphism, we can add a `Triangle` class with an `area` method and `printShapeArea` will still work, as is. As long as `Triangle` inherits from `Shape`, we don't have to modify the source code to `printShapeArea` at all. Better yet, `printShapeArea` can be compiled into a library prior to the existence of `Triangle`, and it will work due to the runtime binding. This is powerful stuff, and it is a cornerstone of OO programming.

In addition to the `area` method, we can add the `perimeter` method to the `Shape` class. Again, its implementation should return 0, as it is intended to be overridden by subclasses. This will allow us to create a `printShapePerimeter` function in a similar vein to the `printShapeArea` function. By doing this, we are saying a shape must be able to calculate its area and perimeter. Our final `Shape` class should look like the code in Listing 10 and Listing 11.

Listing 10: Shape.h

```
#import <Foundation/Foundation.h>
```

```
@interface Shape : NSObject
{

```

```
- (float) area;
- (float) perimeter;
```

```
@end
```

Listing 11: Shape.m

```
#import "Shape.h"
```

```
@implementation Shape
```

```
- (float) area
{
    return 0;
}

- (float) perimeter
{
    return 0;
}
```

```
@end
```

For the sake of completeness, Listing 12 is the accompanying `main.m`:

Listing 12: main.m

```
#import <Foundation/Foundation.h>
#import "Shape.h"
#import "Rectangle.h"
#import "Circle.h"
```

```
void printShapeArea(Shape * shape);
```

```
int main (int argc, const char * argv[])
{
    NSAutoreleasePool * pool =
    [[NSAutoreleasePool alloc] init];
```

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```

Rectangle * rectangle;
rectangle = [[Rectangle alloc] initWithLeftX: 5
                                         bottomY: 5
                                         rightX: 15
                                         topY: 10];

Circle * circle;
circle = [[Circle alloc] initWithCenterX: 10
                                       centerY: 5
                                       radius: 3];

printShapeArea(rectangle);
printShapeArea(circle);

[rectangle release];
[circle release];

[pool release];
return 0;
}

void printShapeArea(Shape * shape)
{
    float area = [shape area];
    printf("Area is %.2f\n", area);
}

```

Protocols

Our geometric shape class library is progressing nicely. We've got classes for rectangles and circles, as well as a common base class for future extensibility. New shapes can be added and, through the magic of polymorphism, the code impact is minimal. However, if you're a perfectionist, the `area` and `perimeter` methods of `Shape` may be bothering you. Their sole purpose is more of a placeholder for

subclasses than doing anything useful. Sometimes, you have to live with a bit of ugliness due to the limitations of the language. However, Objective-C provides a better alternative. Instead of making `Shape` a class, we can make it a *protocol*. A protocol is like a class with only an interface and no implementation. It's used to specify a common set of methods that a class *must* implement. Our `Shape` class transformed to a protocol would need only the `Shape.h` header file shown in Listing 13.

Listing 13: Shape.h for a protocol

```
#import <Foundation/Foundation.h>
```

```
@protocol Shape
```

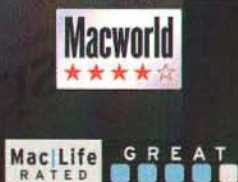
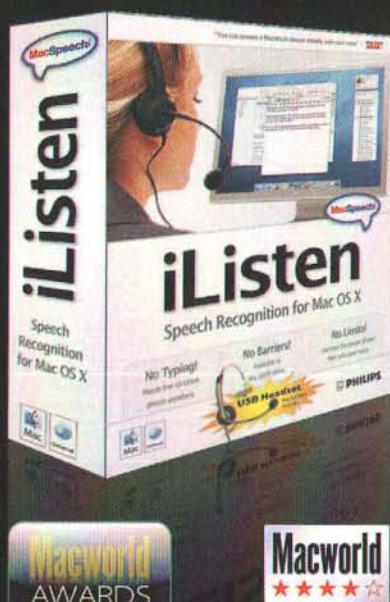
```
- (float) area;
- (float) perimeter;
```

```
@end
```

This looks similar to our previous class header file in Listing 10. We use the `@protocol` keyword and there is no area to define instance variables. Protocols are not allowed to have instance variables. If you need 'em, you'll have to use a class. To use this protocol in our `Rectangle` class, we use a bit of new syntax in the `@interface` line:

```
@interface Rectangle : NSObject<Shape>
```

This states that `Rectangle` is now a subclass of `NSObject` again, however by putting `Shape` in the angle brackets, we're declaring that `Rectangle` implements the `Shape` protocol. This means that we must implement all methods in this protocol. We



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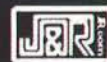
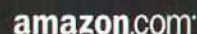
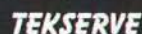
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already do this, so we don't have to make any further modifications to `Rectangle`. We can make similar modifications to `Circle` to make it implement the `Shape` protocol, too.

We must now change our `printShapeArea` function, since the `Shape` class no longer exists. In order to get the benefit of static type checking we must declare the function as follows:

```
void printShapeArea(NSObject<Shape> * shape):
```

This says that `printShapeArea` accepts an `NSObject`, but not just any old `NSObject`: only `NSObject`s that implement the `Shape` protocol. So now we've really got the ultimate solution. We've got our type safety, we've got our polymorphism, and we've got no useless code. The implementation is the same as before:

```
void printShapeArea(NSObject<Shape> * shape)
{
    float area = [shape area];
    printf("Area is %.2f\n", area);
}
```

It's worth noting that protocols can also inherit from other protocols, similar to class inheritance. For example, we could create a `DrawableShape` protocol that inherits from the `Shape` protocol:

```
@protocol DrawableShape <Shape>
- (void) draw;
@end
```

Any object that implements the `DrawableShape` protocol must implement all three methods: `area`, `perimeter`, and `draw`.

Conclusion

Inheritance and polymorphism are the final pillars of object-oriented programming. Along with the concepts of classes and encapsulation, you're well on your way to becoming an OO guru. With these OO building blocks under your belt, we can start getting into the details of Objective-C and the standard class libraries. I hope you join me next month in *The Road to Code*.

MI

About The Author

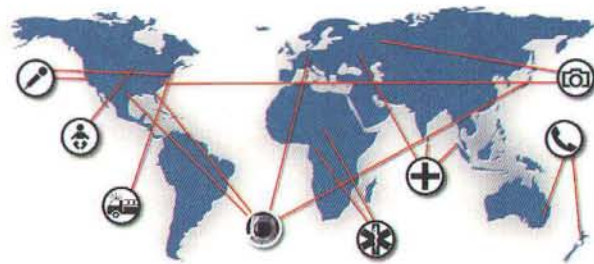


Dave Dribin has been writing professional software for over eleven years. After five years programming embedded C in the telecom industry and a brief stint riding the Internet bubble, he decided to venture out on his own. Since 2001, he has been providing independent consulting services, and in 2006, he founded Bit Maki, Inc. Find out more at <<http://www.bitmaki.com/>>

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Managing Your Loadset, Post-Deploy

How to keep machines up to date from a central location

by Brian Best

So, you've finally done it. All of your software is updated and volume-licensed. You've built your disk images. Your NetBoot restore server is up and running for deployment. And finally, the dream of easy reloads and setups of your Macs has come to fruition.

Then that tiny little update comes out: the critical bug fix that's not part of your Loadset. Or you've discovered a small glitch in your logout hook. What do you do now? One way would be to deploy your Loadset on a clean system. Install the update. Then re-image and redeploy. Yuck. All that work for a simple updater, and another one will likely be there tomorrow.

You could go back to "sneaker-net". Load the files on to a flash drive and walk it around to your workstations. Double yuck.

Building disk images for deploying loadsets is fantastic when you are wiping an entire volume and reloading all of the "installables". But sometimes you need more precise ways of making minor changes to your Loadset. Better yet, software that can manage and track these changes is ideal.

In this article, we'll explore solutions for managing your Loadset, post-deployment. Our focus will be on products that can run exclusively on the Mac: Apple Remote Desktop (with Task Server and Package Builder), University of Michigan's Radmind tools, FileWave, and LANrev.

Other solutions may exist, like LanDesk, for example. LanDesk has a client for Mac OS X that will accomplish our goal. However, since LanDesk's server component can only run on a Windows server, it does not fit our criteria.

One more exclusion that I'm sad to make, and it certainly won't win me any popularity contests here in Jayhawk-country: I have to exclude netOctopus by Motorola nee Netopia. I have concerns about the future of the Mac development of netOctopus now that it's no longer in the hands of a company that has a strong history of Mac development and support. The

fact that it has not been updated in over a year, and that it's not a Universal Binary lends credence. I'd ask some of the developers at Netorola, but I'm sure they are under some kind of hush order. Hopefully I'm wrong and they are too busy trying to get the new version out the door to take my call anyway.

At the end, we'll look at how these tools handle the new challenge to the Mac admin: Windows. Many new Mac purchases are predicated on the fact that the user has either BootCamp or virtualization of a Windows OS at their fingertips. Most of the time, it's so they can continue to run just one or two Windows-only apps, but we all know how vital it is to keep Windows well-patched and virus-defined.

Apple Remote Desktop

It's conceivable that you already have ARD in your arsenal of network tools. If so, you can leverage it for simple software deployments using both the "Install Package" and "Copy Files" features.

Install Packages is most useful for any Apple deployment, as they will already be in the ".pkg" based in .pkg format. Granted, if you're running Mac OS X Server, you can use its ability to mirror Apple's updates. However, since many third party installs are now also based on packages, using ARD for the process becomes more appealing. In addition to being easy to deploy, you get the added benefit of having a receipt left over for things like permission repair. The process is relatively simple. Select your target computers, add the package (or packages) to the "Install Packages" dialog. Set your options, which include whether or not to reboot (which in the case of certain installs like an OS update is mandatory), where to run the task (see below), and how to deal with problems like interruptions or network bandwidth.

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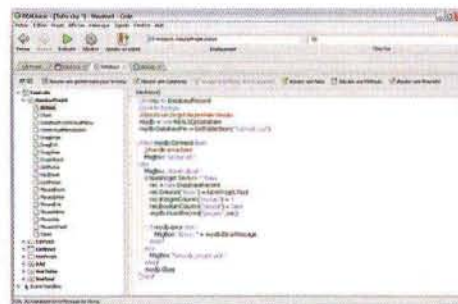
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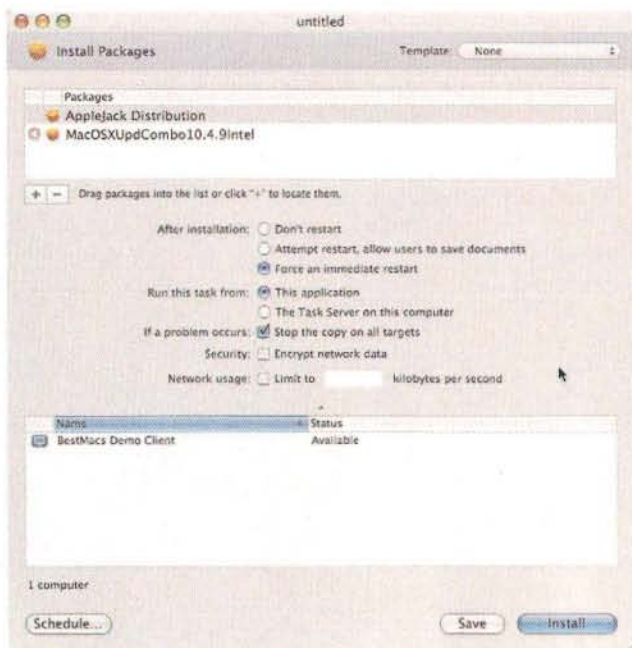


Figure 1 – Using ARD to install packages

One of the greatest new features in ARD 3 is the Task Server capability. It does require another license of ARD, but the extra expense is worth it, if you plan to use this solution for Loadset Management. While ARD tasks can be scheduled (note the button in the lower right) it's often difficult to catch those MacBook users while they're running out of the building. If you have a task server setup in your preferences, you can assign the "Install Packages" command to be performed by it. In addition to freeing up your computer for other tasks, the Task Server will watch for unavailable target computers to come on-line and perform the install when it sees them. While this may not be ideal for OS updates (since the user may abruptly reboot), for simple updaters it may be just the thing to ensure everyone stays current.

What if the items you want to install are not part of a Package file? ARD can still fit the bill. It includes PackageMaker for making your own .pkg distributions. How to use it is beyond the scope of this article, but if you pull out your December 2006 MacTech, there's a great how-to on PackageMaker.

Even if PackageMaker is more complex than you want, you can still leverage the "Copy Items" function of Apple Remote Desktop. When you get right down to it, an installer is really doing up to two things: copying files to the right locations, and executing pre and post flight scripts. Many non-Package installs don't even do the scripts part: they are just disk images that tell you to drag-and-drop files on to your Applications folder.

With that knowledge, if you wanted to distribute the latest build of Camino to your Loadset, you could simply mount the Camino disk image, drag the Camino.app into the "Copy Items" window and fire away.

You could do the same with virtually any file or folder, even shell scripts that you would use as a login hook. Just add your own destination folder to the "Copy Items" dialog.

While the "Copy Items" dialog lets you set owner and group on the file, you may want to use the "Send UNIX Command" function to send along a chmod to be sure.

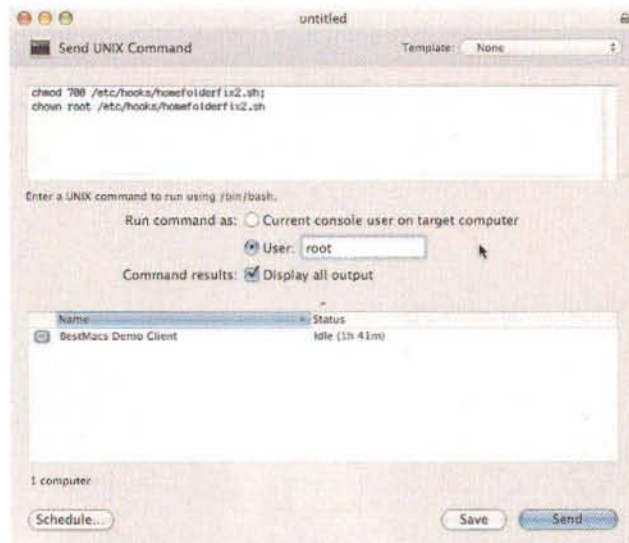


Figure 2 – Following up with Unix permissions

But what about something more complex like an update that uses InstallerVISE to apply to an existing file set. This where ARD might be able to accomplish the goal but it gets a little cumbersome. You would have to install the update on a test workstation, figure out where all the pieces went, and then use "Copy Files" to send all of those individual pieces to the target workstations. Additionally, "Copy Files" is not a command that can be handed off to a Task Server. That's a bit too much manual labor for most administrators.

Bottom line: ARD works great in concert with Package-based installs and a Task Server, but it isn't going to be capable of handling all situations unless you want to put in substantial time to either build packages or manually determine what to copy. It can also be pricey. Two copies (one for you, one for your Task Server) can set you back almost \$1000. But, if you're using it for its screen sharing and inventory management features, this is one more way to leverage Remote Desktop and make it that much more valuable.

Radmind

Of all of the items this article will examine, Radmind may be the most appealing because of one factor alone: its price tag. If you're even giving Radmind a look, be sure to thank the development team at the University of Michigan. (Sorry, Ohio State fans.) Not only do they put significant ongoing work into this project, they distribute it for free (provided you leave their copyrights in place).

So for clients who need a good Loadset Management system, but don't have the budget for some of the commercial products available, Radmind is a winner.

Radmind is primarily a UNIX tool with the guts of its operation accessible from the command line. After installation, you can look at /usr/local and (as you might



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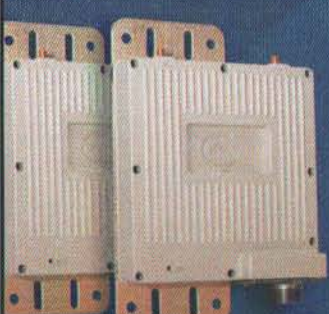
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expect) find your executables in bin and really good documentation in man. And if you're serious about using Radmind in the long-term, you'll want to get to know the contents of these folders. But, if you download and install the Radmind Assistant installer in addition to the radmind tools, you'll have Mac OS X GUI apps to get you started: the Radmind Assistant, Radmind Transcript Editor, and Radmind Server Manager.



Figure 3 – Radmind OS X GUI components

Start off by installing the software on both a test server, and a client that is running your current Loadset. If you open Radmind Assistant on your server, you'll be presented with the "First-Time Run" dialog that will assist you in getting stuff going.

Choose "I'm new, and I want to setup a Radmind server." Then decide if you want to let clients discover your server with Rendezvous—er, Bonjour. When done, you'll get to use the Radmind Server Manager. This gives you your first hint about how it works.

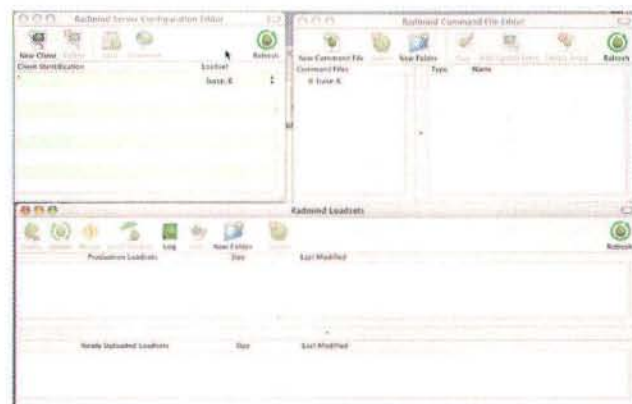


Figure 4 – Radmind Server Manager

Radmind Server Manager is split into three windows.:

The "Radmind Loadsets" window displays all of your "transcripts". Transcripts are text files that detail installed files and folders, their extended attributes like permissions and modification dates. Initially, this window will be empty, because you have not made any transcripts and uploaded them. For reference, transcript files usually end in ".T"

The "Radmind Command File Editor" lets you build your "command" files. A command file is just a text file that lists a collection of transcripts that make up your complete installation. You'll note that a default command file is here; called "base.K" Yes, command files end in ".K" As you would expect, "base.K" is empty, since you have no transcripts to add to it.

And finally, the "Radmin Server Configuration Editor" lets you edit a simple config file that determines which computers use which Loadsets (or more accurately, which command files). You can specify clients by IP address, a range of IP addresses, and domain names. Additionally, a wild card means that any client can connect and get a designated Loadset.

If you're doing all of this in the command-line, you'll find all of the above in /var/radmind. Look for the config file, the command folder, and the transcript folder.

At install, the server is pre-configured to allow all clients and to use the default Command file (base.K). Since there are no Transcripts on the server yet, that's where we begin on the client.

Your first client needs to be a clean copy of your Iloadset. I'd suggest a fresh deployment to an erased hard drive. Then, install the Radmin packages on to it and open the Radmin Assistant. Just like on the server end, you should see the Setup Steps. This time, choose "I'm new, and I want to set up a managed client."

If you setup Bonjour discovery of your server, the client should automatically detect your server's address. Otherwise, you'll need to enter it here. Likewise Similarly, this is where you can configure more advanced options that are a bit beyond the scope of this article, but they give you a sense of what you can do with this software. If you're just starting out, go with the defaults.

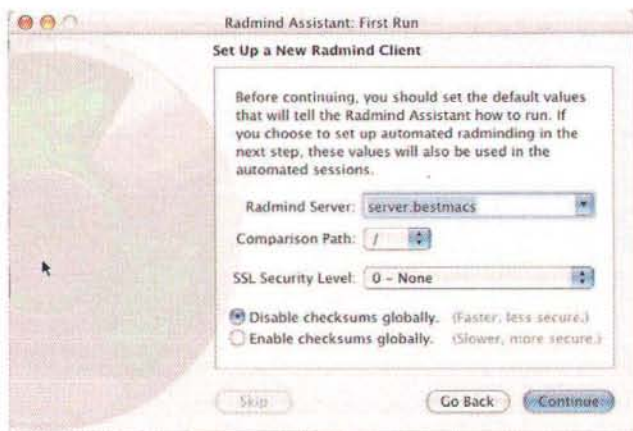


Figure 5 – Setting up the client's preferences on first run

On the next screen, you get the options to configure Radmin automation. If you plan to go with Radmin as your Loadset Manager, you'll definitely want to explore this. Basically, the options will install login and logout hooks for use with iHook (another U of Mich product) to make Radmin execute during those times. It also includes a script for execution by the system's periodic process for daily, weekly, or monthly runs in the background. For now, though, just move past this. These options can be set later, and you may want to tweak the scripts for your own environment.



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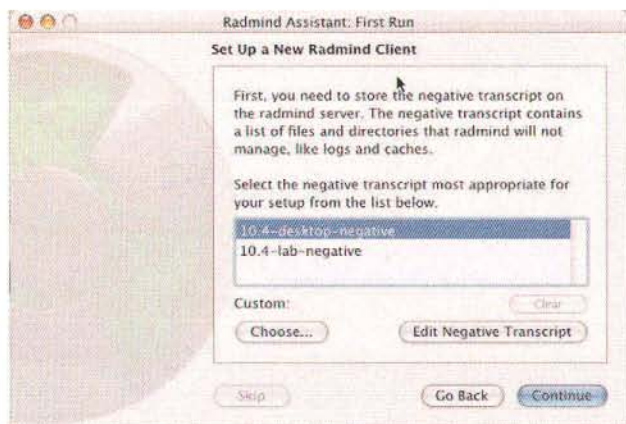


Figure 6 – Choosing your negative transcript

When you reach the screen in Figure 8, you're going to start with your first Transcript: the Negative Transcript. The easiest way to think of a negative transcript is to think of an exclusion list. However, the documentation will tell you that negatives are **not** exclusion lists, and they're right. In real practice, if a file or folder is listed in a negative transcript, Radmind will make sure it is present and then leave it alone and not manage its contents. You might not see the usefulness at first, but think of a situation where you need to have a folder present, but you don't care what's in it. For many Loadsets, /Users/Shared is a good example. The developers were good enough to give us default negative transcripts for both a lab environment and a desktop environment.

That brings us to the Golden Rule of Transcripts: always edit them! There's bound to be some file or folder in a

transcript that you'll want to prune out before uploading it to the server. The negatives are no exception. Fortunately, there's a handy "Edit Negative Transcript" button sitting right there. This will launch the Radmind Transcript Editor application and let you check out its contents.

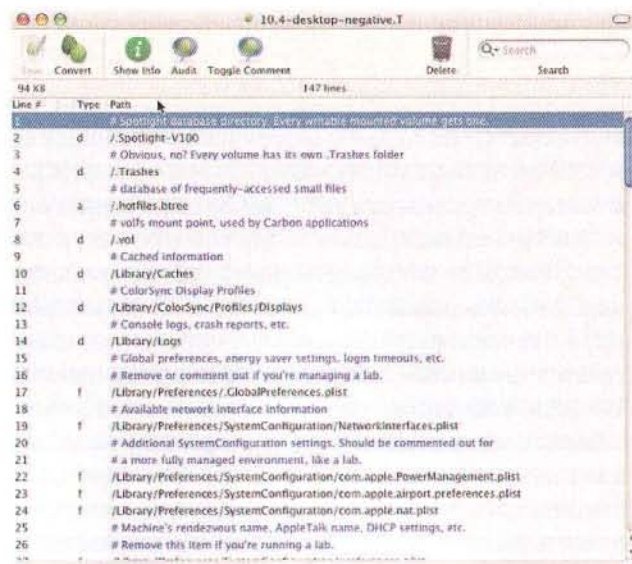


Figure 7 – Editing the negative transcript

In the negative presets, the developers were nice enough to document each line with comments about why you should exclude these files from Radmind management. Edit as you see fit. By the way, Radmind Transcripts are

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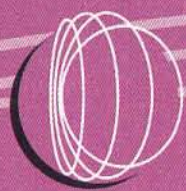
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really just text files, but they are much easier to edit in their own app. Here's See Figure 10 to see what they look like in a text editor.:

```
# Spotlight database directory. Every writable mounted
d /.Spotlight-V100 0600 0 8
# Obvious, no? Every volume has its own .Trashes folder
d /.Trashes 1333 0 8
# database of frequently-accessed small files
a /.hotfiles.btree 0600 0
# volfs mount point, used by Carbon applications
d /.vol 0555 0
# Cached information
d /Library/Caches 1777 0 8
# ColorSync Display Profiles
d /Library/ColorSync/Profiles/Displays 0775 0 8
# Console logs, crash reports, etc.
d /Library/Logs 0775 0 8
# Global preferences, energy saver settings, login time
# Remove or comment out if you're managing a lab.
f /Library/Preferences/.GlobalPreferences.plist 0644
# Available network interface information
f /Library/Preferences/SystemConfiguration/NetworkInter
```

Figure 8 – Raw transcript data

It's your call.

Now it's time to upload this transcript to the server.

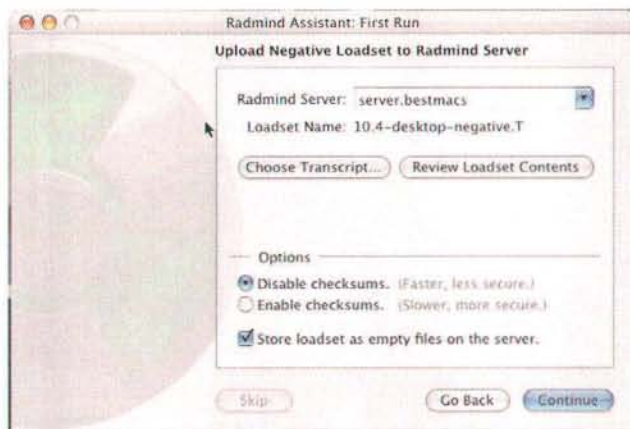


Figure 9 – Uploading transcripts to the server

Since it is a negative transcript, and Radmind won't manage these files, it makes sense to check the "Store loadset as empty files on the server." But you'll want to uncheck that box on the next go round. Hit the continue button and the client will upload the transcript to the server. If you move back to the server and refresh the "Radmind Loadsets" window, you'll see that it found the new transcript wants to move it into production. Hit OK. It will do a quick scan and then offer to add the transcript to your default command file.

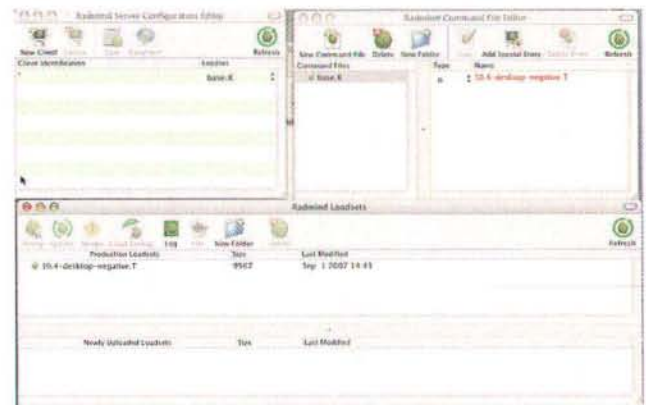


Figure 10 – Radmind Server after adding the negative transcript

Back to the client now. Here's where the fun begins. We need to create our first positive transcript. But first, we need to tell the client that the command file it's using now has the negative transcript. You do this by running a standard update procedure, and the client should be ready to do this, realizing that you're still in your first steps. The client will query the server for updates to its command file and download the new command file and any new transcripts. Once it has the production negative transcript in hand, it's ready to build your positive transcript.

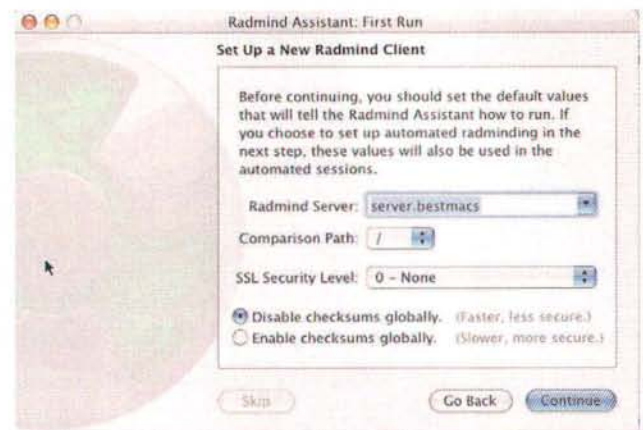


Figure 11 – Radmind getting ready to build the base positive transcript

Feel free to give it your own name. When you press continue, the Radmind client will scan the contents of your boot disk, gathering info about every file and folder that is not already in the negative transcript. It puts this info into a new positive transcript for upload to the server. This time, be sure to leave the "store as empty files" UN-checked. You want these files to be on the server.

On the server end, walk through the same process as the negative transcript: refresh the Loadsets window, update/verify the newly uploaded Transcript, move it into production and

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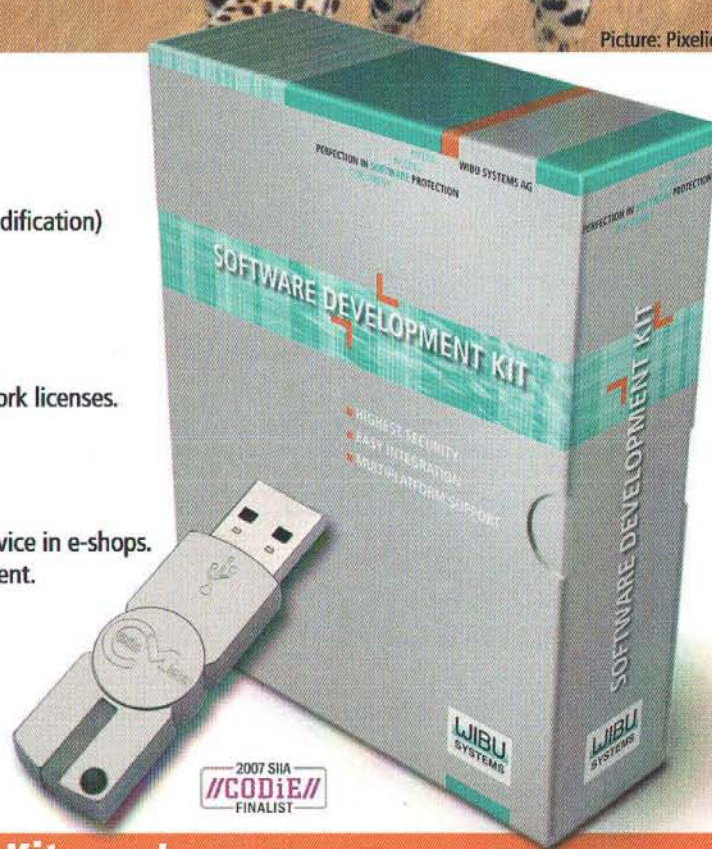
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add it to the Command file. Barring any hiccups, you should now have a working Radmin solution.

Let's try it out. Pretend that you're a naughty end-user who likes to install unauthorized, untested applications. Download a new app or if you're really feeling bold, a Mac OS X Combo Updater, and install it. Now, open up the Radmin Assistant run through "Update this machine."

You might already have the idea, but here's what happens:

Radmin Assistant checks for and if necessary downloads the latest Command file that matches your computer's info in the Config file.

Then the RA downloads any Transcripts specified in the Command file that it doesn't have yet.

RA runs "fsdiff" to compare your existing files and folders against what the sum of its transcripts say you are supposed to have. From this info, it builds an "applicable" transcript of the differences. You can view this transcript before proceeding to see just what Radmin is going to do.

On your go-ahead, the RA is going to run "lapply" which follows the applicable transcript. It will erase any extra files that didn't exist in your Radmin Loadset. It will download from the server any files that went missing or got changed and put them back.

It wants to reboot when done. At that point, the changes you (or your naughty end-users) made are gone.

But what if you want to make permanent changes to your Loadset? After all, that's what this article is about. Once you have a working Radmin solution, adding even minor changes is very easy: you just create a new positive transcript, upload it to the server, and add it to your command file. These new positive transcripts are usually referred to as "overloads". Overloads can be as simple as a one-file modification, a single new software installation, or multiple updates and new software packages. It depends on how you want to organize it.

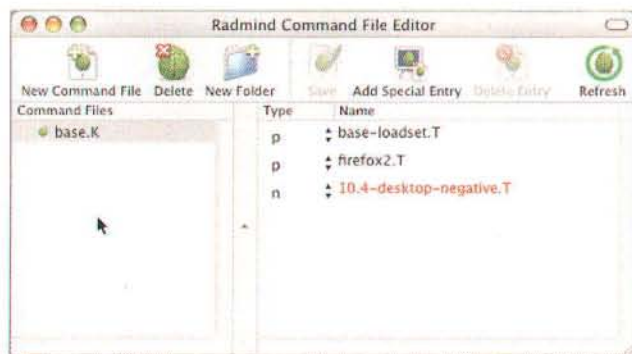


Figure 12 – Adding overloads to the Command file

Note how the overload exists between the positive "base" transcript and the negative transcript in the Command file. Layering of Transcripts in a Command file works from bottom up. Ideally, you want the negative transcript first so that its contents are always ignored. Then you want your overload, which will mostly contain some newer files than those contained in the base positive. Then anything else in the base will be used.

Any of your workstations running the Radmin client will pull down the changes when they are told to run a Radmin update. This can be done manually at each station, or via "Send UNIX Command" in ARD, or through the aforementioned Radmin Automation, which you can access through the Preferences of the Radmin Assistant.

Bottom line: Radmin is perfect in situations where you have complete control of your Loadset. It's flexible enough to handle multiple Loadset configurations and can be set up with automation that works well if your IP scheme or DNS can support it. You can also do some advanced configurations with your command files and transcripts that makes short work of deploying retail licenses (as opposed to volume licensing) and deploying a single new transcript to all of your loadsets. Heck, Andrew Mortensen at umich even got an Intel version of Mac OS X to run on a G5 by stacking Radmin transcripts. So there's a *lot* of power here.

But where it fails is that to harness that power, you've got to put some serious effort into tweaking your Transcripts, and possibly even the included hooks. For many small shops that's too much work. In the setup I've described, Radmin is an all-or-none solution. For example, while it may be possible, it's not immediately obvious how one would just use Radmin to deploy an application without managing the entire boot disk and all of its applications.

That being said, it sure is hard to ignore that price tag. Many times, it's not hard to get approval to implement free software. :-)

FileWave

FileWave, by FileWave USA, Inc. and its sister product AssetTrustee bring us into the realm of non-Apple, commercial products. So, right off the bat, it's going to eclipse our previous two products in the fact that FileWave is going to work cross platform and it's going to have commercial-level support behind it.

The basic breakdown is that FileWave is responsible for software distribution, where AssetTrustee tracks licenses, hardware, and well...assets. FileWave is the product that fits the scope of this article, but as you go through FileWave's menus, you can tell that the company has made these products to be complimentary.

When you look at the FileWave install disk, you see four Package files representing the four FileWave components:

The server, FileWave Server, installs on your designated machine that will house all of the software files that are to be distributed. Obviously, this computer should be highly available and have plenty of room. The client, "fwcl" installs to all of your managed computers.

Much like Server Admin or Workgroup Manager on OS X Server, the FileWave Admin can be installed on any administrative workstation, as well as the server itself.

And then, there is the final component, the FileWave Booster. As the name would suggest, the Booster provides redundancy for your FileWave Server. Clients will be directed to try and contact the Server first, and then try up to 5 Boosters.

Since they are all .pkg based installs, if you're curious about what it's putting where, you can dig into them easily enough if you're curious about what it's putting where with the Show Files command of the Installer.app or with Pacifist. Pretty much all three hang out in the background as daemons, and they are all pretty easy to identify in Activity Monitor or top. The server, for example, runs as "fwxserver."

When you install the client, you are presented with a client Setup Assistant.



Figure 13 – FileWave Xclient Assistant

Obviously, you'll need to enter your server address and port number, but notice the little Bonjour symbols next to the fields. Don't be surprised if the client automatically finds your server. The ability to designate the first Booster should suggest to you that having multiple Boosters might not only provide some fault tolerance, but also allow for some load distribution for larger networks.

The client name and password will be unique to FileWave; your users will not need to know them. The fact that the server authenticates to clients is useful in larger organizations, where you might have more than one FileWave service in play. Each server can manage a unique set of clients. The Desktop Owner Name is the "shortname" of the primary user of the computer. Presumably this is for installers that try to add data to the user's home folder.

If you'd prefer to not have to install the client package manually, FW offers two other ways to do it from the FileWave Admin app. The first requires that you have SSH admin access to the workstation; it will send the client software and configuration via SSH to the target workstation. The other lets you do a mass deployment to all of the machines in your AssetTrustee database.

After entering your activation codes, when you log into FileWave Admin, it looks a bit like this:

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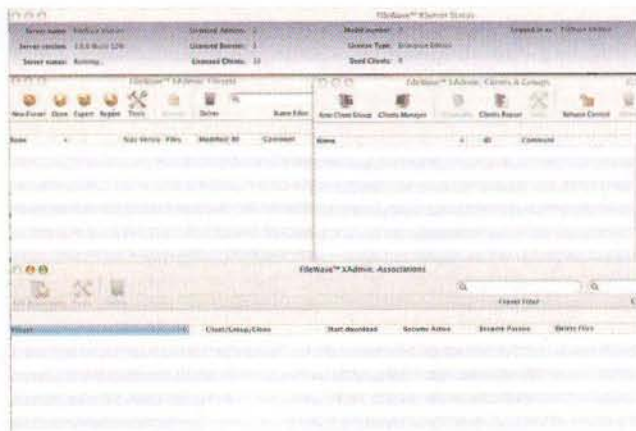


Figure 14 – FileWave Admin

At the top, you'll notice a status window that gives you a summary of what your license allows, versions, and the Model Number. (More on that in a moment.)

The "Clients & Groups" window, as you might guess from the name is where you'll add your clients and group them. And that's the first thing you'll want to do: add your clients. Do this by clicking the "Client Manager" button. A new window appears that lets you organize the clients and their groups.

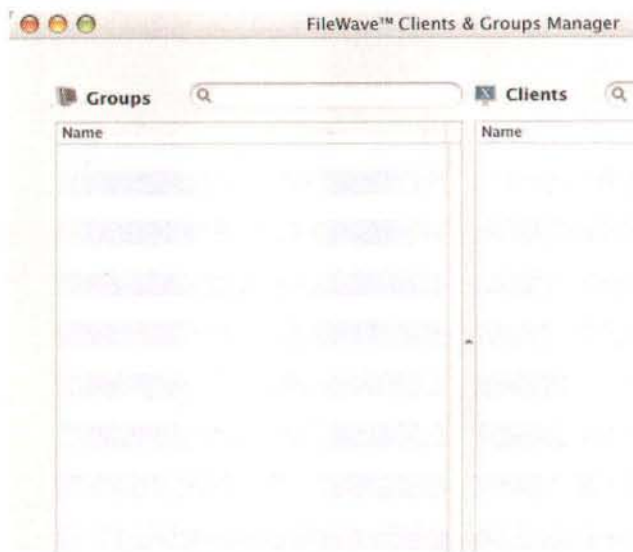


Figure 15 – FileWave Clients & Groups Manager

In the lower right corner, click the "New Client" button. When you get into the new client area, you can see that the FileWave developers have given a lot of thought to leveraging existing tools that you may already have, like an LDAP or AD server.

If you pre-define your Groups, you can put clients into them as you add clients to the list. Otherwise, you can always drag and drop them later. Configure the groups in the logical

arrangement that makes sense for your organization. Since the Clients will contact the server on their own, you need not worry about matching your IP scheme or DNS to the logical groupings you'll use in FW.

You can also specify that a single client exist in multiple groups with a familiar aliasing method. Option-drag a client into a group and the client appears in the group with a cute arrow on its icon and italicized text.

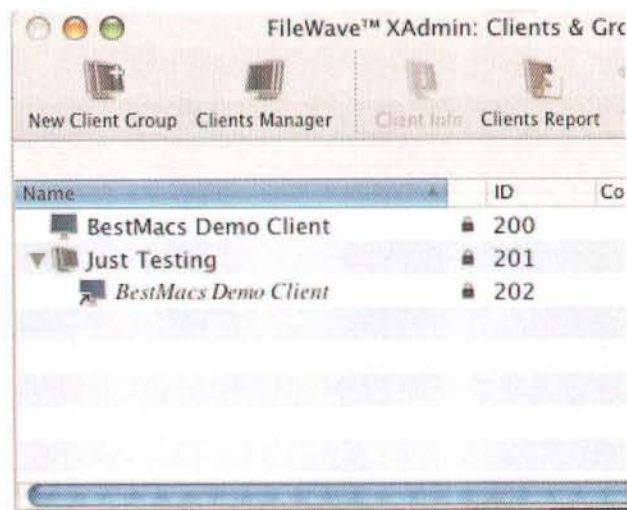


Figure 16 – A populated clients and groups window

In the "Filesets" window is where you start to add software for FileWave to deploy. By far, the easiest way to create a fileset is with simple drag-and-drop. Sticking with the Mozilla-based browsers, adding Camino to the mix simply requires dragging the app from its disk image into the FW Filesets window. It confirms that's what you want to do and then copies all the data from the app into the FW Server's file store. You do the same thing with Package based installers; the difference is that, instead of parsing the package and putting the files where they need to go, FW hands the entire package off to the FW client in /usr/local for installation on the client side.

But those are the easy kinds, right? What about VISE or other third-party installers? For this, you go under the Assistants menu and select FileSet XMagic. The process is very similar to that of generating a Radmind Transcript: first, FW generates a "snapshot" of the entire volume to which the software will be installed. You then install the software, open it, license it, configure it, etc. Return to FileSet XMagic and Create the Fileset. It compares the current state of the volume with the previous snapshot to isolate the differences and adds them to its new Fileset. Clearly, it makes the most sense to do this from a computer very much like the Loadset you are trying to manage. Remember, that FW Admin can run on any computer on the network and talk to your server remotely.

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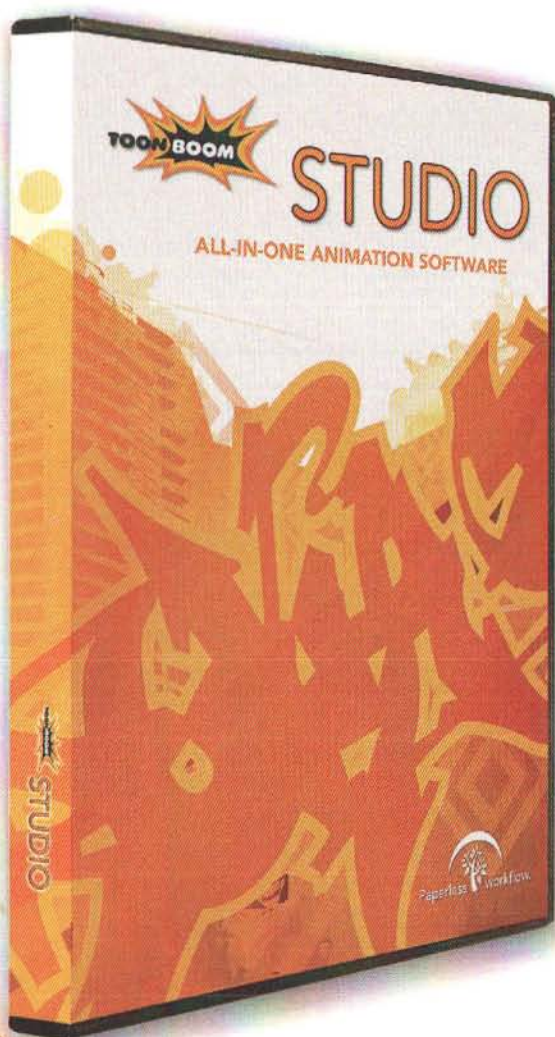
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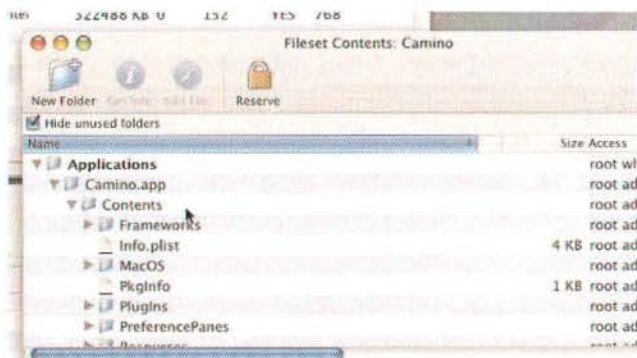


Figure 17 – Examining Fileset Contents

Once a Fileset is in the Filesets window, you can edit its contents by double-clicking the fileset entry. From here, you can modify the names of files and folders as well as extended attributes. You can also delete unwanted items or move things to different locations. Take notice of the "Hide unused folders" checkbox in the upper left. If you uncheck it, you'll see the common folder hierarchies of both a Mac OS X box and a modern Windows box along with where your files reside.

The final window of FW Admin that we have yet to discuss is the Associations window. This is where you say, "I want these files on this group of computers." And it, too, is simple drag and drop: just drag a Fileset from the Filesets window onto a computer or group in the Clients & Groups window and you'll see the association appear.

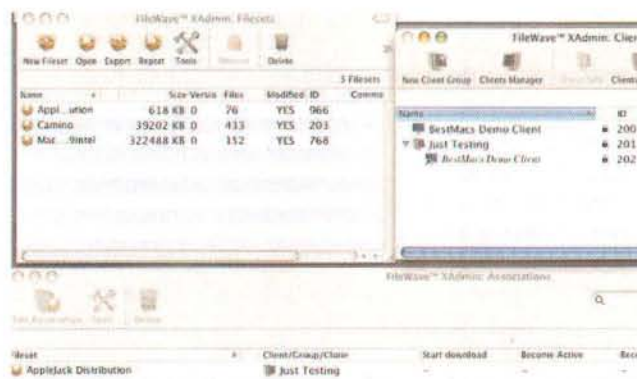


Figure 18 – Setting up Associations

A nice feature of Associations is the ability to individually schedule them. Just double-click an association from the list and set times for downloading, activation, inactivity, or deletion. The disparity of installation and activity is particularly interesting. You can designate that download begins immediately, but it only gets moved to its active location (so people can use it) when you dictate. This would be especially useful if you have a number of laptop users and want to ensure that everyone starts using the new version at the same time. Or if an update does not go well for compatibility reasons, you can leave it installed in anticipation of a bug fix, and simply deactivate it until the fix is ready.

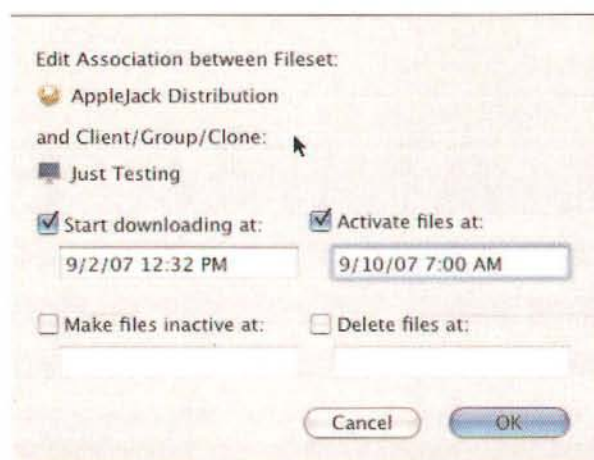


Figure 19 – Association options

Now after all of this setup you've done so far, nothing has changed. FileWave works with a database. When you make changes to any of the windows in FW Admin, those changes are not committed until you save the changes to the database. FileWave calls each combination of clients, filesets, and associations a "model" and as mentioned earlier, you can see which version of the model you are using in the Status window. You commit changes to the model by selecting Update Model from the FileWave Xserver menu. Likewise, if you make changes that you decide you don't like, before you go and commit to them, you can select Revert to Last Model.

After you update the model, take a look at what's going on with your client by right-clicking it in the list of clients and selecting "Open Client Status Monitor". While you've got the menu open, take a look at all the other commands they have added for your convenience; again leveraging other tools you may have.



Figure 20 – FileWave Client Status Monitor

Don't be surprised if you can't catch it actually copying the data from the server to the client. The way you can tell everything is talking is by watching your Model version. If the model version displayed in Client Status Monitor matches the current Model version on the server, the client is up-to-date. If you really want to

be sure, click the Client Log button, as it will reveal any errors that may have occurred. To check the Model number on all of your clients, simply click the Clients Report button on the Clients & Groups window.

Another nice component of FW is that you don't have to schedule clients to make sure that everything is still present. They automatically check in with the server on a repeating basis to make sure that their Models are up-to-date and that the files they are supposed to have are still there. You can do this manually as well by clicking the Verify button in the Client Status Monitor.

Bottom line: FileWave is an extremely capable and scalable Loadset Manager. Its features are clearly designed with the administrator in mind. Support from the company appears to be very good; they include a lot of references to get you up to speed quickly, and then you can explore the user manual to get more in-depth into its capabilities. Matching FileWave with AsseTrustee's capabilities can only increase its usefulness.

It seems that earlier versions had a bad rap on the interface, speed, and system demands, but the reviews for version 3 seem to indicate that these issues are no more. If you haven't given FileWave a look lately, it might be time to download a new demo.

So, if you have the budget, and prefer to have a company's support team backing your solutions, FileWave is a winner.

LANrev

LANrev is a product of Pole Position Software. The model by this point should seem familiar: LANrev includes three components, a server, a client (called an "Agent"), and an administrative program.

Upon opening LANrev's admin program for the first time, you are walked through a setup assistant, asking for initial administrator name and password, server addressing, port numbers, and the option to retrieve authentication info from an existing LANrev server. Then, it brings you to the Computers window.

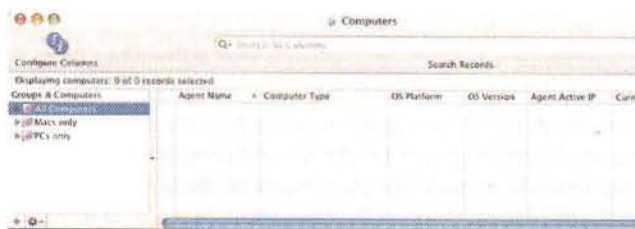
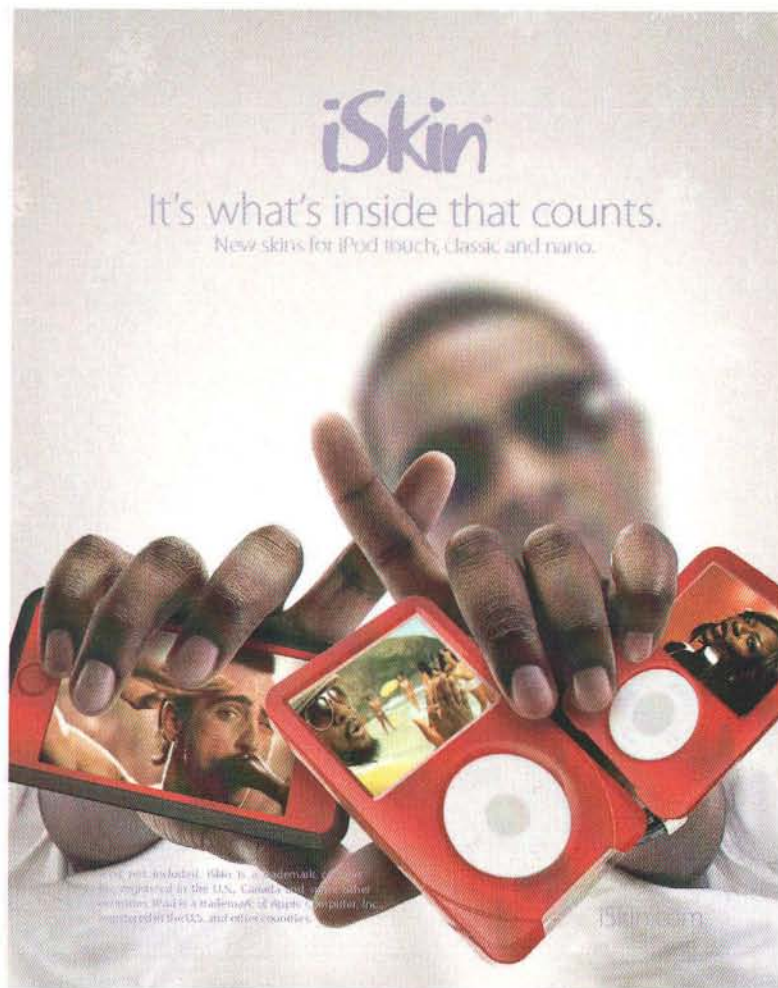


Figure 21 – LANrev Computer window

First impression of LANrev's interface should scream "iTunes" - clearly they have adopted the look and feel that Apple is presenting in its products, possibly in order to achieve a sense of uniformity. That's not a bad thing - chances are you already know how to get around the LANrev windows.

The Computers window is empty, of course, until you install Agents. The Mac Agent installer is a package. But a more



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interesting way of installing the Agent is via the built-in "Agent Deployment Center."

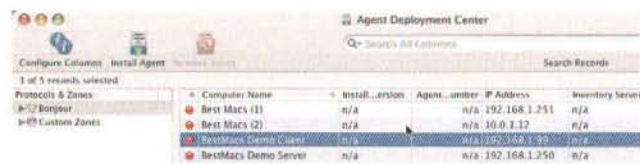


Figure 22 – LANrev Agent Deployment Center list

Select one or more stations discovered via Bonjour, and the system will ask you for an SSH login and password, as well as server configuration info, like in Figure 26.

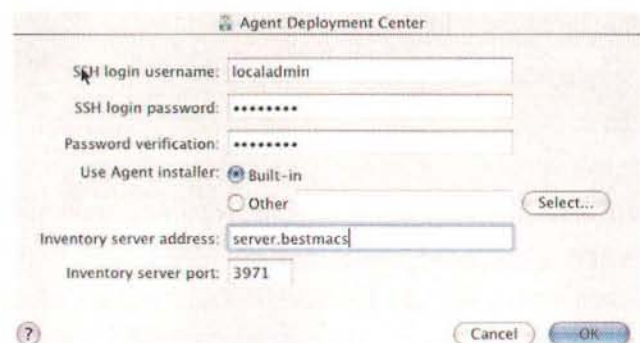


Figure 23 – LANrev Agent Deployment Center client login

Once your clients are installed, the computers list will be populated. If you don't see it immediately, select "Synchronize All Tables" from the "Server" menu to update the Admin's info. I found it necessary to do this often to make sure I had the latest info.

Right off the bat, you'll see that LANrev is looking go beyond Loadset Management. Double-clicking a computer in your list reveals a wealth of information, akin to System Profiler. And if you go under the "Commands" menu, you'll notice a number of administrative tasks that might even give ARD a run for its money.

Before it can do what we want LANrev to do, the Agents need to gather info about their hosts and send it along to the Server. They do this automatically over time, but some initial information needs to be gathered manually. Do this by selecting "Gather Inventory" from the Commands menu. Check the box that says "Force full inventory" and click the Execute button.

Deploying software with LANrev can be done in the same mannerisms as ARD: copying individual files and folders to different locations on a target disk by using the "Transfer File/Folder Command." And again like ARD, you can copy down an installer and have it execute by using the "Execute Macintosh File" command. The problem is that you have to click through the buttons on the local workstation through something like VNC, or give instructions to your end-users. To really accomplish these sorts of tasks in LANrev, you're going to

want to use the Software Distribution Center. Access it via the Window menu.

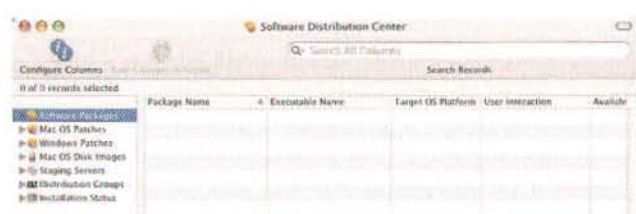


Figure 24 – LANrev Software Distribution Center

Looking at the list on the left of the window in Figure 27, you'll see the three main components to the SDC: software packages, staging servers, and distribution groups.

A staging server is going to be responsible for storing the data and distributing it to clients. An interesting capability of LANrev that aids in scalability of this feature is that any Agent can be a staging server, provided that it talks back to the main LANrev server. Carrying it a step further, any LANrev agent can also be a mirror of the main staging server. For small networks there is nothing wrong with having the LANrev server and the staging service on the same box. Set up your staging server in the SDC window by clicking the "gear" and selecting "New Staging Server."

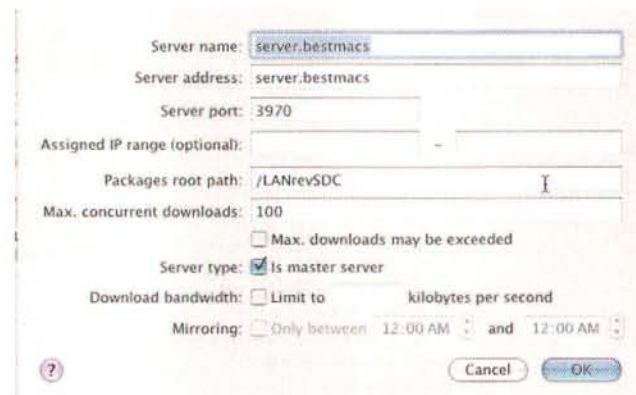


Figure 25 – LANrev Setting up a new staging server

Note how you can define the root path of where software data is going to be stored. What I put in the window of Figure 28 is not a default - you could put the data on any attached volume. But, wherever you decide to store it, treat it like an iPhoto Library: modify it only through its application. The "mirroring" checkbox went gray when selecting this staging server to be a "master server." I left the assigned IP range blank, but presumably this would be an additional source of load balancing for your staging servers.

Now that this is in place, you'll want to add some software packages. Hit the "gear" again and select "New Software Package." I should clarify the use of the word "package." Usually, when we Mac admins think "package" we think of the "yellow-orange translucent cube coming out of the cardboard box" icon

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and ".pkg". It seems that when LANrev uses the word "package" they mean a collection of installer data that is packaged for distribution by LANrev SDC.

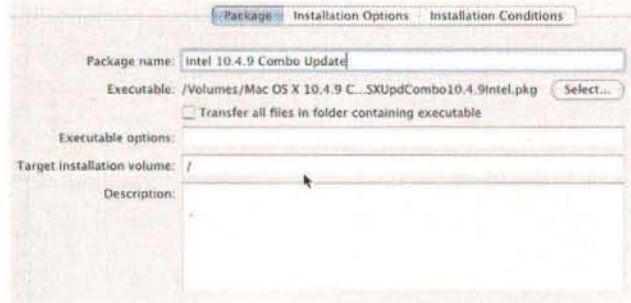


Figure 26 – LANrev New software package

In Figure 26 I have hit the Select button and pointed it to the ".pkg" I wanted. The "package name" field is unique only to LANrev as an identifier. It can be whatever you want to call it. Notice that I have designated the root as the target installation choice, which makes sense for this kind of update. Leaving it blank would have had the same result, as "/" is the default.

LANrev also lets you select disk images here. Keeping with our theme, if we were looking to install Camino or Firefox, unlike the other software we have looked at, for LANrev, we'd keep it in its disk image and select the ".dmg" as the Executable. Using disk images may be a big boon to this software as it can match up the contents of a disk image with

the target volume. While I didn't test it to see how well it works, you could theoretically deploy an entire Loadset through the LANrev interface and skip NetBoot/ASR altogether.

This once again brings us to the difficult installers. LANrev's solution to the problem is an application called LANrev InstallEase.

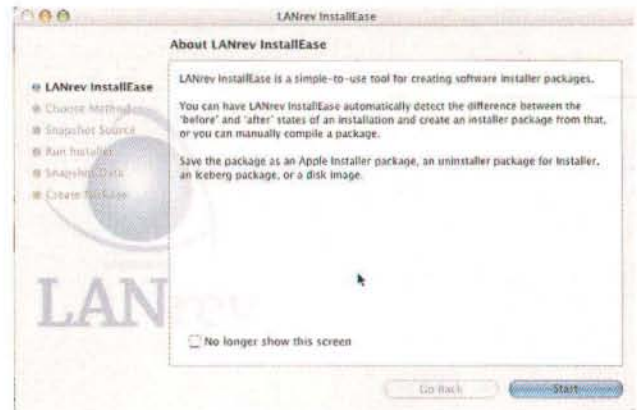


Figure 27 – LANrev Install Ease

InstallEase gives us the same scan - install/config - capture differences as we've seen in the other apps. One difference is that InstallEase will also let us manually specify the locations to capture. So if you already know what goes where, you can skip the scanning process. One other surprising feature of InstallEase is that it will create an



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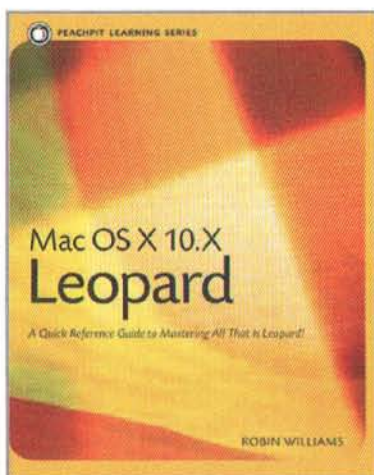
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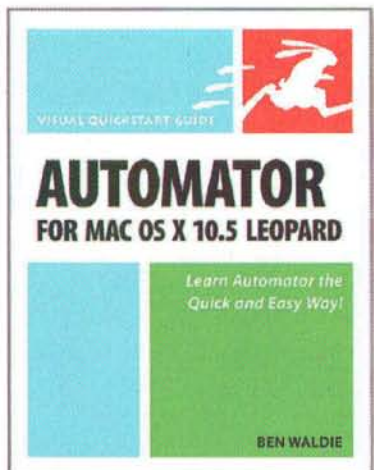
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"uninstaller" package from an existing .pkg file. The fact that InstallEase saves the results into a more widely compatible installer format makes InstallEase appealing in its own right, independent of the rest of the LANrev suite.

Back to our setup in SDC, click the "Installation Options" tab.

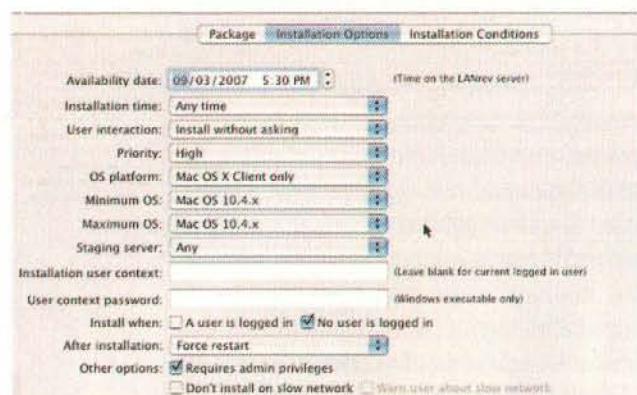


Figure 28 – LANrev Package Install Options

The options are what you'd expect from any installer, with a few notables: the User interaction option can give the end-user a chance to defer the install to a later time, or just do it without their knowledge. You can define a particular staging server that will run this install. Also, the checkbox to ensure that no one is logged in when installing the software may be a welcome addition, especially in the case where a reboot is required.

And finally, the third tab lets you define conditions for install. By default, it will install the software on all targets. But, if you want to throw in some safeguards, this is the place to do it. Click OK to save the LANrev package.

Finally, we need to setup our distribution groups. By default, two groups already exist: "All Macs" and "All PCs". If you want to define smaller groups than that, just click the "gear" and select "New Distribution Group". Add individual computers to it through drag and drop from the "Computers" window. You'll also want to assign a staging server to each distribution group. Again, it's just drag-and-drop the staging server from the Staging Servers list into the "Assigned Staging Servers" section of the Distribution Group. You can also do this by editing the Staging Server's preferences.

Once you have all three items ready to go, performing an install is simple: just drag-and-drop the software package on to the distribution group, and the assignment is made.

But, you're not done. Since the Admin software can be run on any workstation, you need to commit the changes to the LANrev server. Do this by clicking the "Save Changes to Server" button in the upper left. When you do, you'll see all of your packages upload to the staging server.

You can check on the status of installs by looking at the Installation Status section of the SDC window. The process

is completely automated, and sometimes doesn't happen immediately.

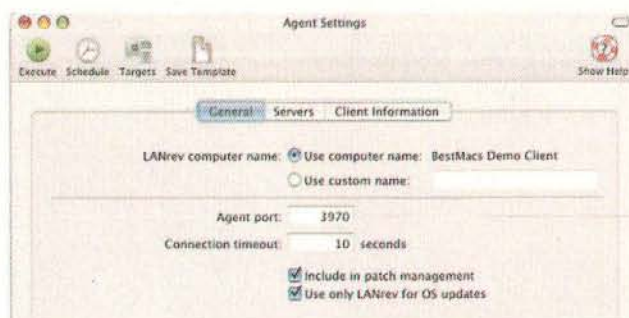


Figure 29 – Use only LANrev for OS updates

One unique and highly useful feature of LANrev is its ability to leverage the built-in software update mechanism of the OS. When Software Update detects a new update for the computer, the LANrev agent checks in with the SDC to see if it already has the update. If it does not, the Agent will download the update package, upload it to the server and put it in a group of the SDC called "Unconfirmed Updates". Before these get deployed, you have to go into the group and approve them by dragging them on to your Distribution Groups. If you'd rather not, drag them to the Rejected Updates group.

Bottom line: More so than any other program in the list, we haven't scratched the surface of what LANrev can do. We only focused on the features specific to Loadset Management, and it clearly does so much more. As the chief competitor to FileWave, it's only fair to mention that I did not evaluate Asset Trustee versus LANrev for things like license management and hardware inventory. Because it does so much more, LANrev seemed a little less intuitive to me than FileWave, but once the settings were in place, it functions very similarly.

Again, it's commercial software, which means you'll be shelling out some dough for it, but you'll also be getting some support resources from the developers. Given the swiss-army-knife-like amount of stuff you can do with LANrev, especially beyond the scope of this article, my suggestion is that if you can buy one, and *only* one set of tools for managing your Mac network, LANrev would have to be the choice.

Windows Support

I left Windows support for the end because if you're not dealing with it, then the rest of this article is of little importance to you. For those of us dealing more and more with cross platform deployments, even in a once all-Mac shop, the tools above have varying degrees of Windows capability.

Dealing with BootCamp is essentially dealing with a Windows PC that just happens to have an Apple logo on it.

No doubt you're using some sort of distribution method, like Mike Bombich's NetRestore for putting it out there. But after that what do you do? And while at first glance, updating the virtual disks of Parallels or VMware might seem simple enough - shoot one big file across the network - it's really the same dilemma. You have a Loadset in a disk image and it needs updating.

Our first product, Apple Remote Desktop does ... uhh... well, it will VNC into the Windows box. So at least you can "sneakernet" from your desk. Yeah.

Radmind has a PC version of its Tools. They aren't updated nearly as often as the Mac/UNIX versions and they are a work in progress. They are essentially Windows ports of the command-line tools (no GUI assistants) with "ntfsdiff" instead of "fsdiff" and some extra registry tools. They also included some sample negative transcripts to get you started, but they are not defaults. You'll want to generate your own. Take a look at the Radmind Wiki for more details and how to get going:

<http://webapps.its.umich.edu/radmind/index.php/Radmind-pc>

FileWave is going to be much easier here.

FileWave WinClient Assistant

Welcome to the FileWave Client Setup Assistant.
Enter the appropriate values to complete the installation.

IP or DNS Address Port #

Server:

Booster 1:

☒ Use Computer Name for WinClient

WinClient Name:

WinClient Password:

Password (Confirm):

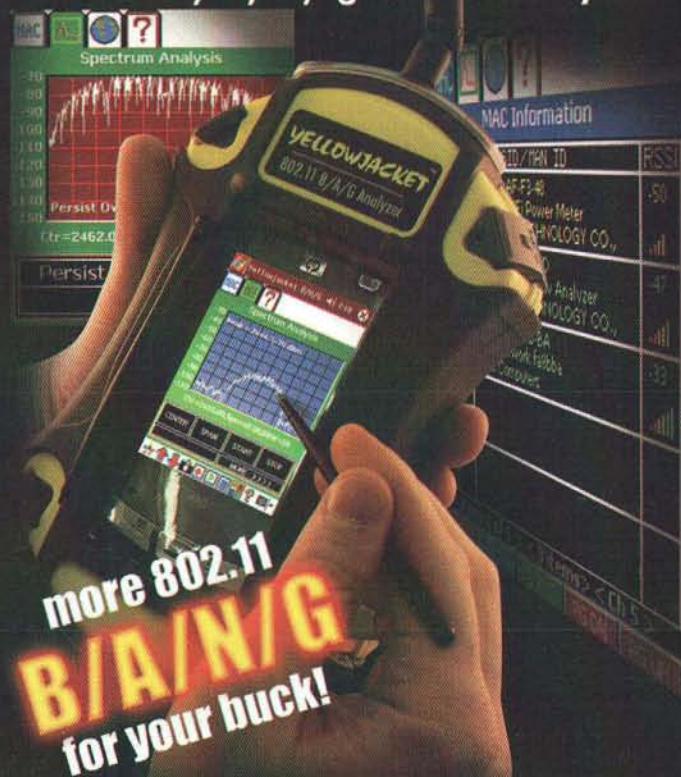
Desktop Owner Name:

Figure 30 - FileWave Windows Client

Look familiar? And once you get into the FW Admin, adding the client is essentially the same process. Mac and Windows clients sit side-by-side in your Clients & Groups window. Much like was done with Mac package installers, the Filesets window supports importing .MSI installers. The

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only trick is to be sure to edit the Fileset and drag all of the other support files that are with the .msi into the Fileset's contents. If you need the Magic component that scans the disk before and after to obtain the differences into a FileSet, the Windows installer includes a program to do the activity.

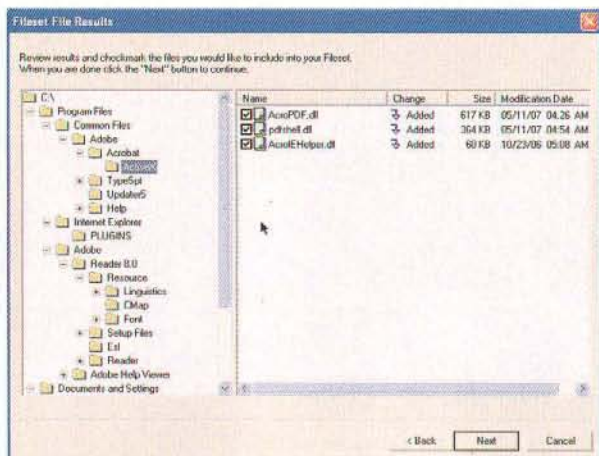


Figure 31 – FileWave Magic in Windows

LANrev takes Windows compatibility the furthest of the bunch in that every one of its functions can be installed on a Windows system and interoperate with the Mac components. The LANrev Admin for Windows operates smoothly talking to the same server that I had setup on my Mac OS X box earlier.

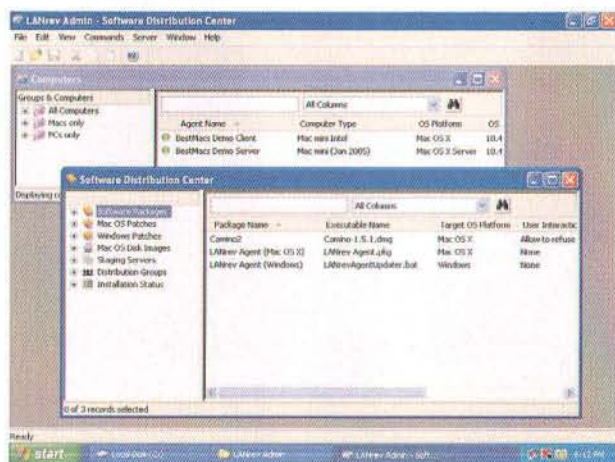


Figure 32 – LANrev Admin in Windows looking at the same server as the Mac version

In fact, you may want to have LANrev admin on both a Mac and a PC, regardless of which OS runs the server, so that you can create software packages on each platform. One caveat to remember when dealing .msi installers is to check the box for "Transfer all files in folder containing executable" when creating the Windows installer package.

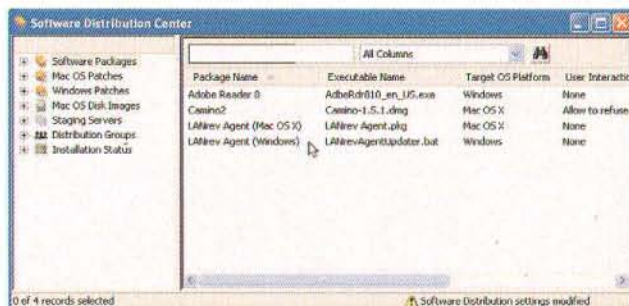


Figure 33 – LANrev SDC in Windows

So if all of your available storage space is sitting attached to a Windows box, you might want to go with LANrev, just so the Windows box can be your staging server.

Conclusion

Like any other solution that you deploy, the Loadset Management system that you choose is going to depend on a number of factors. You should sit down with the demos of all of the applications at your test network and use this article, along with the product documentation, to evaluate them for yourself. Find out which one makes the most sense for your budget, time, skill level, and needs. Then rest happy knowing that the next time Software Update pops up, you're not looking at big redeploy.

MI

About The Author

Brian Best has been a self-employed Mac Consultant for seven years, serving the Northeast Kansas area and presenting Mac troubleshooting seminars nationally. When not working, he can be found sleeping, watching movies at home with his wife Candi giving Netflix a run for their money, frequenting Kansas City's world-famous barbecue establishments, or screaming his throat raw at Arrowhead Stadium.

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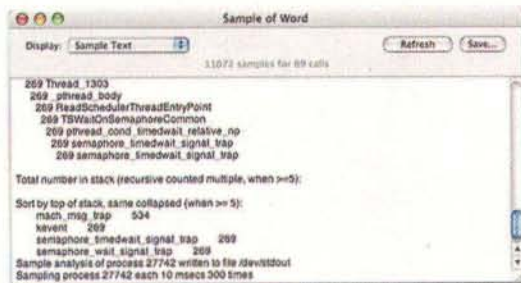
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Peter N. Lewis

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What do you do?

CEO, CFO, CTO, Programmer, Tech Support, etc

How long have you been doing what you do?

I started program on the Mac and releasing Freeware and then Shareware on the Internet in 1990, and formed Stairways in 1994 when my revenues began to exceed my day job's salary. So have been writing Mac Software, mostly Internet related and all Internet distributed, for 17 years now. Early this year I sold our flagship program, Interarchy, to our lead developer, Matthew Drayton, who formed Nolobe to continue it, so currently it is just me working on Keyboard Maestro which is a macro program we acquired a few years ago.

Your first computer:

My first computer was a TRS-80 Model 1 Level 2 with 16K of RAM and a Tape Drive. Which means my current computer is a thousand times faster and approaching a million times more memory than my first. After that, I had an Amstrad 6128 and then a Mac Plus, and then a succession of many different Mac models (the Mac LC 475 still holds fond memories as an early elegant Apple computer).

What attracts you to working on the Mac?

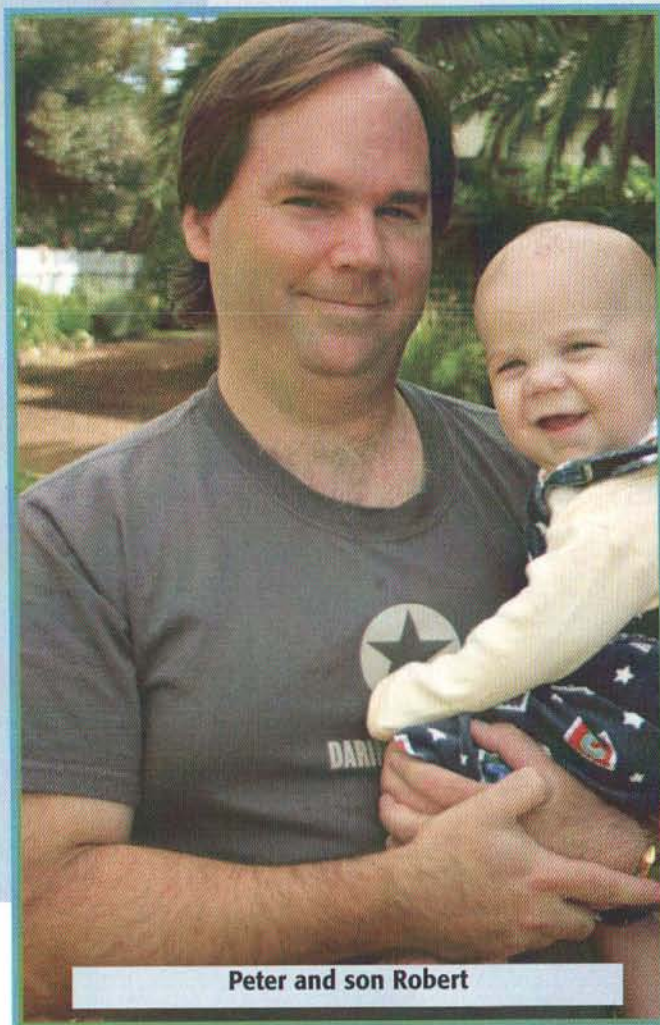
The attention to detail. You can't get away with anything less than checking every pixel on the Mac. Every button needs to be lined up just right, every icon placed in just the right position. It forces you to think very clearly about what the customers will see.

What's the coolest thing about the Mac?

The discernment of the customer base and the consequences that has for the software I get to use. Pretty much all the software I use on the Mac is elegantly done because it simply would not survive otherwise.

If I could change one thing about Apple/OS X, I'd:

I would like to see Apple tone back a bit on dictating to the customers what they can and can't do, especially where there is no good reason except some idea of "Interface Purity". I'm not talking about allowing iPhone applications, there may be good reasons for that sort of choice. More things like not allowing customers to override the Command-Tab key, or delete the Movies folder. The things where there is no good reason to stop the customers from making changes.



Peter and son Robert

What's the coolest tech thing you've done using OS X?

Probably Internet Config. Every time you click a URL in Mail or BBEdit and it opens a browser window in Safari, you're using the remnants of Internet Config which was originally written by Quinn, Marcus and I back in 1994. We released it into the Public Domain to ensure widespread adoption, and it was eventually incorporated into the Mac OS system software as well as supported by innumerable applications.

Where can we see a sample of your work?

At <http://www.keyboardmaestro.com/> you can download or read about Keyboard Maestro.

The next way I'm going to impact IT/OS X/the Mac universe is:

Currently I am working on the next major version of Keyboard Maestro which will extend the ways you can control your Mac in some quite new directions. After that, I do have an idea for a program I'd like to write, but it is too far off to discuss just yet.

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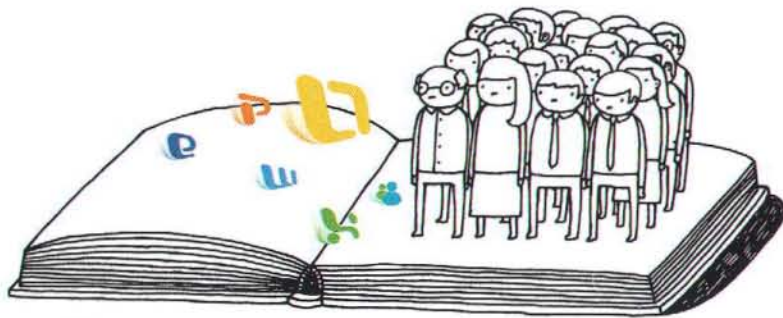
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